The Foundryman's Own Magazine

American Foundryman

JUNE 1953

American Foundryman

Volume 23 **June 1953** *Number 6*

Published by American Foundrymen's Society

Automatic shell-making machines, as pictured on our cover, are important in the future of the foundry industry. James H. Smith's article, beginning on page 42, comprises the C. E. Hoyt Annual Lecture as delivered at the 1953 A.F.S. Convention. In it, he outlines some of the more outstanding opportunities for the industry.

In This Issue . . . .

Departments . . . .

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subscription price in the U.S., Canada and Mexico $3.00 per year; elsewhere, $6.00. Single copies 50c. Entered as Second Class Matter, July 22, 1938, under Act of March 3, 1879, at the Post Office Chicago.

. . . . . GOES MODERN

Another medium-sized foundry mechanized by Jeffrey. A practical solution to the mechanization of a gray iron foundry making small castings. Sand handling and conditioning, mold conveying, pouring and dumping . . . all worked out to provide "tops in mechanization." Moving smoothly through each operation . . . that's the secret.

Whether your foundry is large or small, we will be glad to help you improve operations—make layouts if necessary—to prove that mechanization pays off. Write today.

Large photo—general view of mechanized foundry. Directly above—same shop showing pouring stations.

Uphill or downhill makes no difference with Jeffrey mold conveyors. Note automatic dumper—no men needed here.

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IF IT'S MINED, PROCESSED OR MOVED

. . .*IT'S A JOB FOR JEFFREY!*

Here's How

Here's how two 10,000-lb capacity platform trucks have reaped benefits in conserved manpower, more efficient production flow, and better working conditions for the Anniston Foundry, Anniston, Ala. Principal job performed by these Elwell-Parker platform trucks is the transport of charging buckets, which weigh 9,620 lb when loaded. Buckets are carried on skids by the platform trucks between make-up points and foundry cupolas. Empties are returned for re-loading. Runs are about 100 ft in length. Trucks are also used for other jobs.

For more data, circle No. 1 on card, page 17

Here's how Richmond Radiator Co., Monaca, Pa., protects its workers from eye injuries and respiration difficulties. Employees working in finish grinding of castings for plumbing fixtures are required to wear Dustfoe 55 respirators.

For more data, circle No. 2 on card, page 17

Here's how Woodruff & Edwards Inc. claims to have reduced casting breakage by a full 50 per cent while raising production 14.5 per cent, with cleaner castings, lowered noise level, improved working conditions, and more usable floor area. A single Pangborn LG Rotoblast table made these results possible, raising the rate to 1.523 tons of castings per man-hour from 1.329 in just 30 days.*

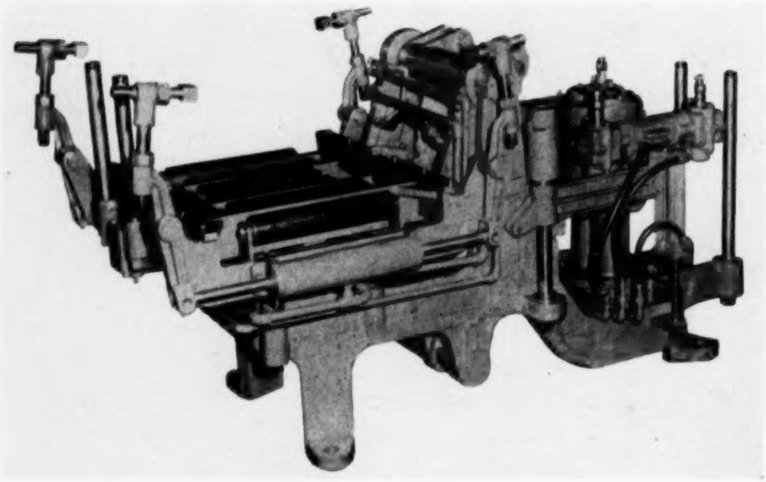
*Reported erroneously in May as 1,523 and 1,329 tons, respectively.

For more data, circle No. 3 on card, page 17

Products and Processes

For additional information, use postcard at bottom of page 17

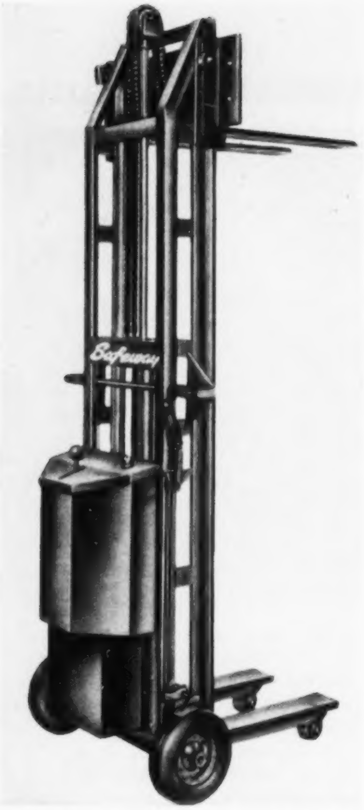
continued on page 17



Rollover-Molder

This GJR Air Rollover, Air Draw Molding Machine is specially designed for hard-to-draw jobs, offers exceptional accuracy of draw, according to the manufacturer's claim. Convenient dual control valves, air vibrators, air-actuated clamps. Complete specifications and full operating information available on request. *International Molding Mach. Co.*

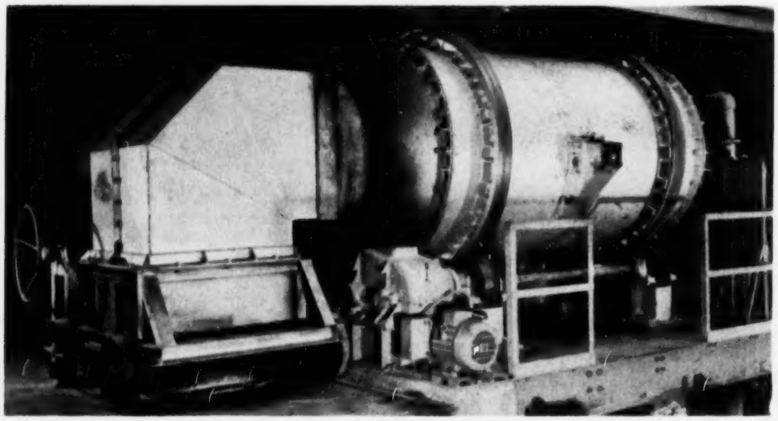
For more data, circle No. 4 on card, page 17



Heavier Lifts—Greater Heights

This powerful new portable Lift-Truck is designed for maximum safety with one-man operation. Lifting heights of 68-, 80-, and 100-in., with lifting rating of 1250 lb. *Safeway Indus. Equip. Corp.*

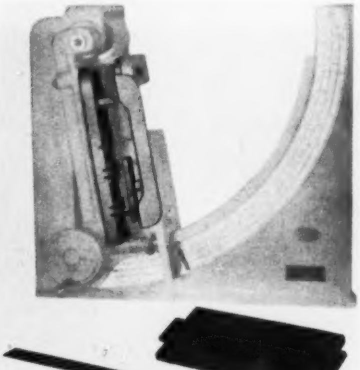
For more data, circle No. 5 on card, page 17



Rotary Melting Furnace

Low consumption and labor costs are claimed for this rotary furnace, featuring push-button, automatic control. Operates equally well on oil, gas or coal. Push-button control possible where successive melts are staggered to allow operator to work several furnaces simultaneously. Slow rotating speed allows melting by radiant heat from lining, providing noteworthy economy. *Stamford Engineering Works.*

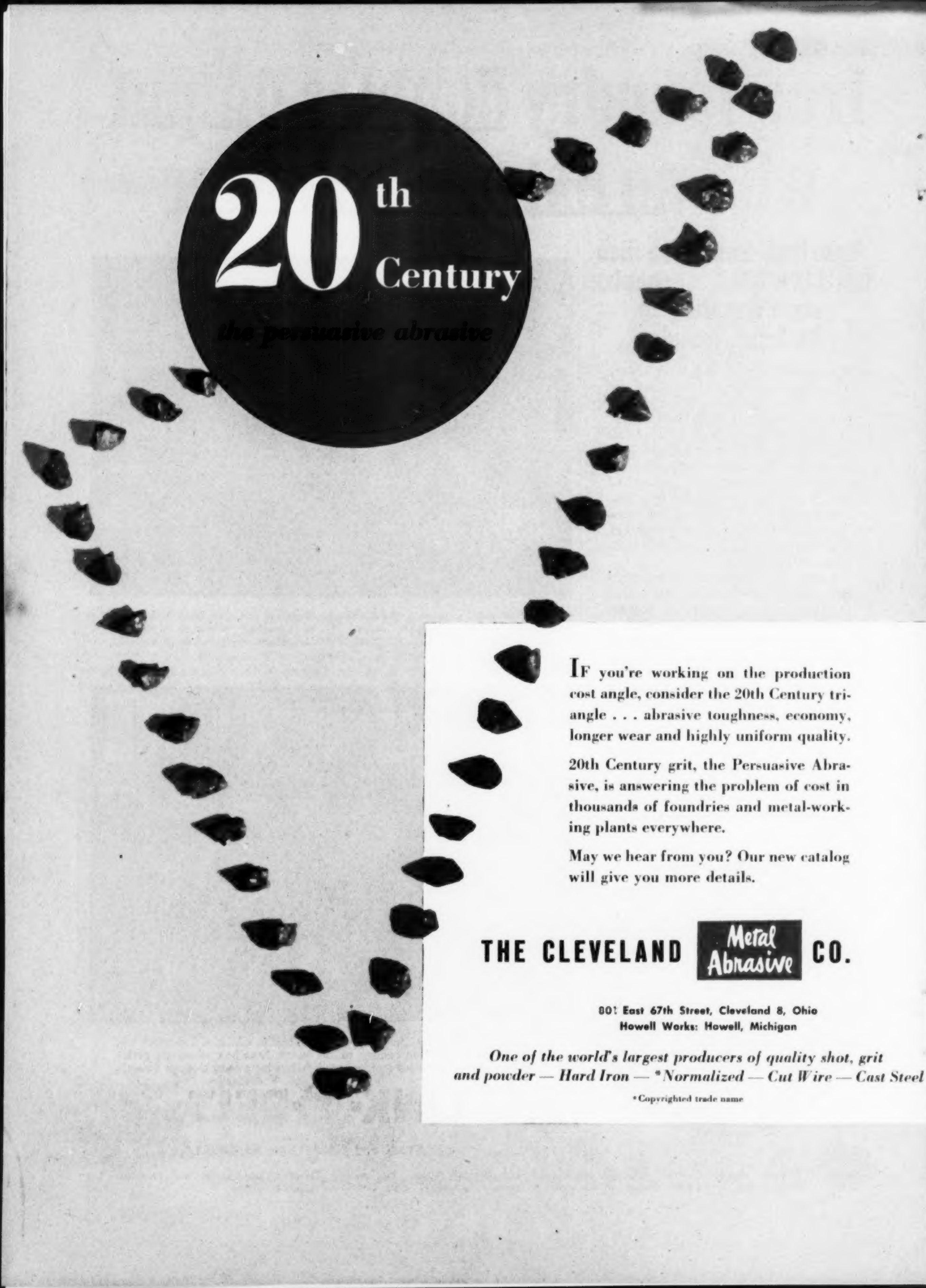
For more data, circle No. 6 on card, page 17



Shell Mold Accessory

You can now test shell mold materials for transverse strength and deflection with this No. 641 Transverse Accessory. Descriptive literature available. *Harry W. Dietert Co.*

For more data, circle No. 7 on card, page 17



20th Century
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IF you're working on the production cost angle, consider the 20th Century triangle . . . abrasive toughness, economy, longer wear and highly uniform quality.
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Talk of the Industry

LATEST ENTRANT in the field of precision casting is the "D" process. Disclosed during the discussion at one of the A.F.S. Convention Shop Courses, the process produces thick "shells" made with conventional equipment and a "contour" drier. Baking takes about 30 minutes in the traditional core oven, followed by a short curing time. Binder is a vegetable oil. Molds are poured without backing material.

MANUAL SKILL AND CRAFTSMANSHIP once so characteristic of most foundry workers is diminishing as foundries become more and more mechanized. At the same time, the call for technical knowledge and supervision increases, and the strain on supervision necessarily grows greater. A British writer predicts that at some future time the job of shop supervisor may become so technical as to require university training. Certainly the highly-trained technical supervisor is now called for in many plants, especially in production and mechanized foundries. The trend calls for intelligent job planning, greater responsibility on the personnel manager, and eventually a realignment of presently understood responsibilities of job supervision. A greater reason for employing and training graduate engineers could hardly be found, yet many in foundry management still do not seem to understand the impact of mechanization and technology on the entire foundry industry.

COMPOSITE MOLD assembled from foamed plaster, shell mold, and permanent mold components is use by a large producer of precision castings. Object is to achieve dimensional accuracy and surface finish needed in a complex, thin-section casting. The parts were cast previously in a mold made up of regular casting plaster and sand cores.

REDUCTION OF SHOP NOISE is receiving more and more attention and several shops are actively working at it. In one, a wood pattern shop, acoustical tile installed in the ceiling to finish off a roof insulation job reduced the noise level 30 percent. Experiments now under way in sound-insulation of an electric furnace melting room appear headed toward satisfactory completion. In a third shop, cleaning room noise is expected to be reduced through acoustical treatment of mechanical shakeout areas.

LEAD SWEAT of bearing alloys cast in shell molds is no problem according to one foundryman. He reports being able to stop it by heating the molds before pouring!

QUICK FRACTURE TEST for melt quality of 85-5-5-5 has two particularly significant uses at Gibson & Kirk Co., Baltimore, Md., according to C. A. Robeck, vice-president. Developed under the direction of the A.F.S. Brass & Bronze Research Committee, the test is used, Robeck says, to check melt quality of heats to be mixed for pouring into a large casting, and to check possible changes in the molten metal from a single furnace during the pouring of a series of molds.

Courtesy Standard Oil Company (N.J.)

Products & Processes

Fill out postcard below for complete information on products listed in these pages.

Continued from page 12

CONVENIENT FORM FOR ORDERING INFORMATION

Springless Dial Scale

This springless, dial-type scale features "fixed center" construction, which is said to prevent misalignment of parts and to assure accuracy despite rough handling and shock loading. Protected by 25% overload safety factor, safety strap prevents lever system from moving beyond limit of chart capacity. Heavy structural steel housing, which is electro-welded in one piece, acts as support for an excess load. Large, adjustable dashpot controls action of dial indicator, enabling pointer to give immediate readings, without usual swinging motion, back and forth. Provision made for taring off all slings, chains, cables, magnet or other lifting members, thus indicating net load on dial chart at all times. This scale is said to be weatherproof and heatproof. Heat baffles are available at slight additional cost. Two standard types are now on the market—one for use in steel mills and in other high-ceiling areas; the other for use where space is at a premium, in low headroom conditions. *Detecto Scales, Inc.*

For more data, circle No. 8 on card.

3-in. Cupola Furnace

Designed for melting ferrous and nonferrous metals and ore reduction on a laboratory scale, a new, low-cost, 3-in. cupola furnace is now being manufactured. It is all-steel construction, has long-life rammed monolithic lining, 6 silicon carbide lined tuyeres, 2 silicon carbide lined spouts, and other features. Operating on coke and compressed air, cupola has capacity of 60 lb cast iron per hour. *Foundry Rubber, Inc.*

For more data, circle No. 9 on card.

Medium-duty Shakeout

Made in four sizes, new medium-duty foundry shakeout has capacities up to 5,000 lb. It is designed for foundries producing smaller size castings. Manufacturer claims fast separation of castings from flasks and molds, rapid reduction of sand lumps, a minimum of flask damage, and a simplified reclamation of reinforcing rods, gaggers and sprues. Provision is made for effectively limiting motion during acceleration and deceleration, thus eliminating hazard of destructive vibration during critical speed range. Vibrating mechanism full-floating and completely enclosed. Reputed to operate dependably under adverse conditions. *Link-Belt Co.*

For more data, circle No. 10 on card.

Potentiometer Indicator

Designed for rugged, heavy-duty factory use, a new Potentiometer Indicator now being marketed is designed to spot impending thermocouple failures, test the operation of other pyrometer instruments, and check such equipment as heating units and test furnaces which do not warrant continuous measurement. The instrument is also valuable as a stand-by, to replace installed potentiometers temporarily out of service. It is completely enclosed in a metal case, with operating knobs and dials protected by removable cover. Clips are furnished to hold report blanks or data sheets. Operates in vertical or horizontal position. Extra-long, 17-in. scale permits close, accurate readings. *Foxboro Co.*

For more data, circle No. 11 on card.

Reader Service Dept.

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Free Foundry Information

For additional information use postcard at bottom of this page

Phenolic Resins

A 90-page booklet is now available which details uses of phenolic casting resins; gives complete information on their properties; and describes and illustrates their applications and the latest methods of handling. It is useful both as an operating manual and as a book of facts on phenolic casting resins. *Marblette Corp.*

For more data, circle No. 12 on card.

Dust Control Systems

Descriptive literature is now available for dust and fume control systems with bag houses containing silicone treated glass fabric bags for operating temperatures up to 500 F. Literature also describes special processed non-shrinking Orlon bags for operating temperatures up to 325 F and long bag life due to the design of the bag shaking mechanism. *Harsell Engineering Co.*

For more data, circle No. 13 on card.

Fork Trucks

No two jobs are exactly alike, so there's no such thing as one best power type. A condensed catalog is now available describing electric, gas, diesel and L. P. gas units and their various advantages. A Driver Training Movie is also available. *Clark Equipment Company.*

For more data, circle No. 14 on card.

Strainer Cores

Free samples of sizes in stock of Ceramic strainer cores are now available. Special samples to specifications are also available at a moderate cost. *American Lava Corporation.*

For more data, circle No. 15 on card.

Mechanized Impregnation

Information telling how equipment and methods give complete and permanent protection against leaks, corrosion and other failures by reported complete filling of all pores, may now be obtained. *American Metalseal Mfg. Corp.*

For more data, circle No. 16 on card.

Dry Core Binder

Technical representative will demonstrate the non-toxic, non-irritating dry core binder that reduces scrap, retains strength in storage and saves 30 to 40 per cent oven time. *Stoller Chemical Company.*

For more data, circle No. 17 on card.

Trackmobile Advantages

Bulletin (T-109), describing how users of Trackmobile are getting savings plus a wide variety of important additional benefits in freight car handling, is now available. The folder presents a case study picture of the machine's advantages, both from a man-hour and dollar standpoint as well as its flexibility in track or road operation and quick changeover from one to the other. *Whiting Corporation.*

For more data, circle No. 18 on card.

Grinding Wheels

A direct mail folder has been issued pointing out how Sterling Resinoid Snagging Wheel specifications are tailored for the job, whether it be swing, frame, portable or floor stand. Backed by an intensive research and development program, these wheels have built into them the ability to solve quickly all problems of high-speed, rough grinding. *Sterling Grinding Wheel Division of the Cleveland Quarries Company.*

For more data, circle No. 19 on card.

Band Saws

Five brochures describing high speed band saws and tilting arbor mitre saw benches are now available. *Tannewitz Works.*

For more data, circle No. 20 on card.

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PIG IRON
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Letters to the Editor

All letters of broad interest which do not violate A.F.S. policy or good taste are publishable. Write to Editor, American Foundryman, 616 S. Michigan Ave., Chicago 5, Ill. Letters must be signed but will be published anonymously on request.

Ornamental Casting

In the April issue of AMERICAN FOUNDRYMAN (Shop Talk, page 160) someone asked about sand for ornamental castings. I'd inform the questioner as follows:

The sand mixture used by most New York City ornamental shops for skin-dried, French sand castings for the past 30 years consists of 2 parts mulled dry French sand, 1 part No. 0 Albany dry sand, and 1 part dry reclaimed facing sand. These should all be run through a No. 30 sieve. To this is added a binder, then molasses water; finally everything is run through the muller.

Riddle about 1 inch of the facing mixture over the pattern through a No. 12 griddle, then fill with floor sand. After rolling over, draw the pattern, spray molasses water on the mold, shake on dry French sand through a flour bag, and then shake on some parting. Replace the pattern, tapping it back into place, and ram up the cope using a facing of 1 part Albany sand, 2 parts floor sand, with binder added and molasses water for moisture.

Under no circumstances use a spray of any sort after drawing the pattern the second time as it will show up on the face of the casting and require considerable finishing. All molds must be skin dried with either an oil or gas torch or other drying method.

This sort of molding can only be accomplished by craftsmen, so high production is impossible.

GEORGE STAUB, *Executive Secy.*
Metropolitan Brass Founders Assn.
New York

Appreciates Results

I just want to tell you how pleased I was with the progress made by the seven cooperating foundries on the hot-tearing problem in their research program for the A.F.S. Steel Division. The meeting of the group . . . was most stimulating.

There is no question but that the Research Committee made a wise decision some time ago to enlist the aid of a number of foundries in its program. I am certain the steel casting industry will be appreciative of the results that are being obtained.

Continue the good work.

C. H. LORIG, *Asst. Dir.*
Battelle Memorial Institute
Columbus, Ohio

Recovering

I am working my way slowly through the many kind and helpful letters received while I was in the hospital. They tell me I had a very close shave but I am happy to say that my recovery has been unexpectedly rapid, although I was not able to attend the A.F.S. Convention and Alumni Dinner this year, worse luck!

JOHN HOWE HALL
Swarthmore, Pa.

From Down Under

We have reprinted the article *New Methods in Metal Patternmaking*, H. J. Jacobson, Industrial Pattern Works, Chicago and attached are two copies of our journal *The Modern Foundry* . . . .

This journal was posted three or four days ago and already we have received telephone calls from local foundries expressing appreciation of the article.

WILLIAM A. GIBSON
Consulting Engineer
Sydney, Australia

Mr. Jacobson's paper was presented at the 1952 International Foundry Congress and Annual Convention of A.F.S. at Atlantic City, N. J.

No Defense

Eighteen months ago our community ward demanded smoke control and the biggest foundry here now has largely completed an installation with amazing results. The air, formerly foul during working days and pure only when the foundry was shut down on week ends, now is unbelievably purer throughout the week. Houses no longer have the paint drop off, porches are not thick with soot, and the housewives are happy and grateful.

There remains, however, the problem of another nearby foundry which still pollutes a considerable area with fumes, soot and sand. It seems to me that this foundry can no longer justify its former defense that smoke control is impractical when the larger foundry across the street has now demonstrated that "it can be done."

CITIZEN
Racine, Wis.

Control of air pollution is a two-way proposition and the A.F.S. Safety & Hygiene & Air Pollution program is designed to encourage closer community-foundry relations.

Puts "Quizmaster" to Work

Your new feature in the March issue of AMERICAN FOUNDRYMAN, entitled "The Foundry Quizmaster," should prove very popular. The discussion type answers were easy to understand, and they contained a wealth of useful information. I am sending a group of questions that I hope you will use in a future quiz. The alloy in question is yellow brass in the 65 Cu-35 Zn class.

CHET MACK, *Foundry Foreman*
Chautauqua Hardware Corp.
Jamestown, N. Y.

Look for your questions and answers in an early issue of "The Foundrymen's OWN *Magazine."*

Already Seeing "Paris in '53"

The letter and brochure on "Paris in '53" was forwarded to me. I'm in Paris to aid in the French foundry productivity program. Every morning on my way to the office I see that view of the Eiffel Tower used on the brochure.

CHARLES F. WALTON
(formerly professor, Case Institute of Technology)

Enthusiastic Apprentices

Thank you for making it possible for our foundrymen and patternmaker apprentices to attend several of your convention's sessions last week and for providing all with badges.

The boys were enthusiastic over this experience. Seven from the Wednesday group filled in applications for membership in your society.

MARTIN BRAUNS, JR., *Director*
Washburne Trade School
Chicago

Outstanding Convention

. . . Everyone seemed to have a good time, and, from what I can see, I think the A.F.S. convention was an outstanding success.

H. KENNETH BRIGGS
Miller & Co.
Chicago

BUCKEYE *CONTINUES TO DEVELOP AND IMPROVE PARTINGS AND FOUNDRY SUPPLIES*

Photo taken in
Peerless Foundry Co.
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NOTE! If you do not have a sandslinger operation and want to make a big savings, try —

***New, Improved* PARLEX**

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Where *dry* parting is indicated, we recommend our

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1 Gal. Sample FREE. Prove it at our expense. Write today!

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Phone Kenmore 6104
Fenton Foundry Supply Co.

Birmingham, Ala.
Phone 4-4754
Foundry Service Company

Lancaster, Pa.
Phone 3-2474
Lancaster Foundry Supply Co.

Foundrymen in the News

American Brake Shoe Co., New York, has elected **N. George Belury** vice-president. Mr. Belury, who will continue as president of the Engineering Castings Div., has been with Brake Shoe since graduation from Purdue. The company has appointed **John Brandenburg** central sales manager of the American Manganese Steel Div. Mr. Brandenburg joined the company in 1930 as an apprentice and advanced through various production positions to plant superintendent. Another appointment was **John R. Welsh** as purchasing agent for ferrous scrap.

The board of directors of Universal Foundry Co., Oshkosh, Wisc., recently elected the following to new management positions: **C. W. Mueller,** executive vice-president and general manager and member of the board of directors; **George A. Zabel,** vice-president in charge of sales; **Roy T. Martin,** secretary and treasurer; **E. C. Gruetzmacher** re-elected vice-president in charge of operations, and **A. C. Ziebell** continues as president and member of the board.

John R. McVeigh has joined the research and development staff as chief engineer of Alloy Engineering & Casting Co., Champaign, Ill. He will be primarily concerned with engineering for

J. R. McVeigh . . . . . chief engineer

all Armed Services research and development projects. Mr. McVeigh, for the past three years, has been research engineer for Kennametal, Inc., Latrobe, Pa. He also served as project engineer for Continental Aviation & Engineering Corp., Detroit, Mich.

Walter R. Jaeschke, Whiting Corp., Harvey, Ill., recently flew to Hallesfornas, Sweden, to supervise the initial operation of two pulverized coal fired duplexing furnaces in the malleable foundry of A. F. Jarnforadling. Installation of the furnaces marks the first such application of cupola to air furnace duplexing in Sweden, and they will be used in conjunction with three primary melters, or cupolas, in the Jarnforadling foundry. Each of the furnaces is capable of producing twelve tons of metal per hour.

William W. Austin, formerly senior metallurgist at Southern Research Institute, Birmingham, Ala., and member of the extension faculty of the University of Alabama, is now associate professor of mechanical engineering and one of the technical directors of the Engineering Research Dept. at North Carolina State College, Raleigh, N. C. Professor Austin will teach courses in engineering and physical metallurgy, and direct a research project on the fundamental behavior of alloying elements in the iron-carbon system.

Ray L. Farabee has been named vice-president of Delta Tank Manufacturing Co., Inc., Baton Rouge, La., subsidiary of General Gas Corp., New York. Mr. Farabee will be in charge of production, engineering, research, and development. Prior to joining Delta, Mr.

R. L. Farabee . . . . . . Delta V. P.

Farabee was vice-president of Central Foundry Co., Tuscaloosa, Ala., where he was in charge of research and development of production processes and methods.

Charles J. Rittinger for the past eight years foundry engineer-metallurgist at American Car & Foundry Co., Detroit, has been appointed general manager of Industrial Castings Co., Detroit.

Harley C. Lee has been elected a director by Basic Refractories Inc., Cleveland. Mr. Lee joined Basic Refractories in 1926 and has been a vice-president

H. C. Lee . . . . new director

since 1945. The company has named **George E. Stone** to succeed the late **W. W. Patnoe** as chief engineer. Mr. Stone joined the engineering department in 1921.

Acheson Colloids Co., division of Acheson Industries, Inc., Port Huron, Mich. has made five recent executive appointments. **Harold J. Dawe** has been appointed technical director. He will be responsible for all research and development activities of the company. **Alden Crankshaw** has been named sales manager with main offices at Port Huron. He has been with Acheson 21 years. Since 1941 he has been eastern service manager of the New York sales office. The New York and New Jersey territory will now be handled by **Paul E. Yoder. John W. Shier,** plant engineer since 1949, has been named production manager. **Earl L. Youse** is the new supervisor of the product development laboratory. **D. Gray Weaver** has been appointed supervisor of publicity and advertising.

Sterling Wheelbarrow Co., Milwaukee, has elected **Richard A. Smith** president. He succeeds his late father **Irving R. Smith.** Other appointments were: **Harold E. Smith,** vice-president; **Martin A. Dooley,** treasurer; **H. A. Frank,** vice-president in charge of purchases; **John T. Hegner,** comptroller; **Wesley J. Mueller,** works manager, and **C. A. Gehrman,** general sales and advertising manager.

American Machine & Foundry Co., New York, elected two new members to the board of directors at the annual meeting of AMF stockholders. New directors are **Murray McConnel** of Cuno Engineering Corp., Meriden, Conn., and **Rodney C. Gott.** Mr. Gott directs the activities of AMF's general products
continued on page 30

"I don't know anything about fancy claims. I've heard how this abrasive's better or that one's cheaper—but all I know is what I see. We use Malleabrasive in our shop and that's one abrasive I'll swear by. It cleans fast and does a good job—you can see the castings shine when they're done. Malleabrasive lasts longer and is easier on the machine, too, so we don't have to stop so often for abrasive refill or parts repair. That means we get more work out. Our shift foreman says that's why Malleabrasive is cheaper in the long run. One thing's sure—we're all sold on Malleabrasive."

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Pangborn BLAST CLEANS CHEAPER with the right equipment for every job

Foundrymen in the News

continued from page 28

group, commercial research and development. **Walter F. Greenwood,** formerly associated with the Air Material Command, United States Air Force, has joined AMF subsidiary, Cleveland Welding Co., as assistant to the president.

The Trinks Industrial Heating Award for 1953 has been presented to four engineers, all industrial executives. The four honored were **Harry H. Harris,** General Alloys Co., Boston, Mass.; **Carl F. Mayer,** The Carl Mayer Corp., Cleveland; **Carl I. Hayes,** C. I. Hayes, Inc., Providence, R. I., and **J. Spotts McDowell,** Harbison-Walker Refractories Co., Pittsburgh, Pa. The award is given annually by a judges' panel to candidates nominated by the industry, for notable contributions to economic or scientific progress in industrial heating. It was established in honor of **Dr. Willibald Trinks,** Professor emeritus of Carnegie Tech an authority on industrial heating problems.

Carl F. Mayer . . . . receives award

Harry H. Harris . . . honored by panel

Adrian J. Archambault had been appointed Michigan representative by Buckeye Products Co., Cincinnati. Schooling at Marquette and Michigan State University, and experience in both jobbing and production foundries have equipped Mr. Archambault to offer a complete engineering service on core room, moulding and cupola problems.

James Gerity, Jr., Gerity-Michigan Corp., Adrian, Mich., has been elected a member of the board of directors of Schultz Die Casting Co., Toledo, Ohio. He is one of the founders of Schultz, which was incorporated in 1930, and has been a secretary of the company since its organization. Mr. Gerity's election to the board is a resumption of the position he resigned from in 1951.

George Staub has been appointed sales representative for Metropolitan New York by Alloys & Products, Inc., New York. He is also on the advisory board of the A.F.S. student chapter, Polytechnic Institute of Brooklyn. Mr. Staub is also executive secretary of the Metropolitan Brass Founders' Assn.

Wilfred H. White recently took over the operation of the Watertown Foundry Co., Watertown, S. D. He was formerly metallurgist with Jackson Iron & Steel Co., Jackson, Ohio.

Gerald V. Kingsley has been named research supervisor and **Edward O. Falberg** production metallurgy supervisor of Bohn Aluminum & Brass Corp., Detroit.

Thomas D. Cartledge has been elected vice-president of Union Carbide & Carbon Corp., New York. Mr. Cartledge has been president of the Linde Air Products Co., division of UCC since 1952. He is also a director and president of Dominion Oxygen Company, Ltd., Canada.

Dodge Steel Co., Philadelphia, has elected chief engineer **Henry J. Kelly** and foundry manager **Edward H. Berry** to the company's board of directors.

Jarl Åkerlund, chief metallurgist at Ab W Dan Bergman, Södertälje, Sweden (Swedish aluminum and magnesium foundry), is visiting principal research laboratories, foundries, and aluminum and magnesium fabricating plants in the United States and Canada.

Charles Kates has been appointed president-general manager of Union Malleable Manufacturing Co., Ashland, Ohio, and its subsidiaries—Ashland Malleable Iron Co., and Union Brass & Copper Co. Mr. Kates, who was formerly vice-president and sales manager succeeds **Sol Jacobson** who has resigned because of ill health. Other executive appointments by the board of directors were: **C. H. Willis,** new vice-president and assistant general manager of Union Malleable. **D. E. Gilman** was named vice-president and assistant general manager of Ashland Malleable. **Homer Sipe** was appointed treasurer-comptroller of the three companies. **Robert L. Fasig** was named director of purchases for the three plants.

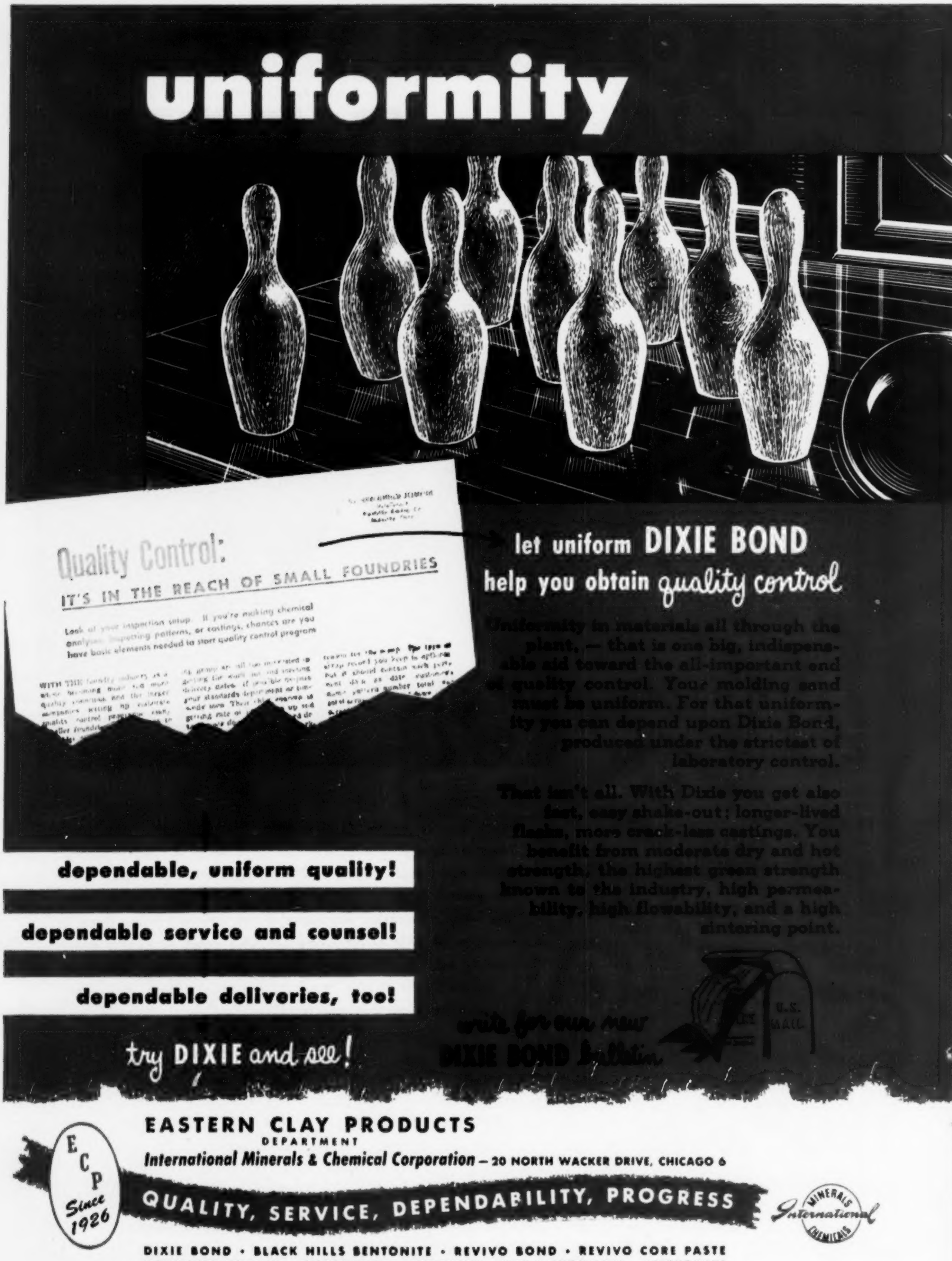
Charles Kates . . . . . new president

Paul A. Pounds, 66, has retired from Paxton-Mitchell Co., Omaha. Mr. Paxton started with Paxton-Mitchell as a laborer in the iron foundry in 1916, worked his way up through various jobs and became vice-president of production in 1939, the job he held at the time of his retirement. He plans to remain in Omaha as a foundry supply representative.

J. E. Brickerhoff, formerly sales manager of the Refractories Div., Babcock & Wilcox Co., New York has been named general manager of the division.

W. G. Munro, foundry engineer with National Engineering Co., Chicago has been appointed to the sales staff for National's Simpson Mix-Mullers.

United States Pipe & Foundry Co., Burlington, N. J., have elected **Fred Osborne** a vice-president. Mr. Osborne has been connected in various capacities with the manufacturing end of Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., since 1926. He was elected president and director in 1952, and continued in that capacity when Sloss-Sheffield merged with U. S. Pipe last October.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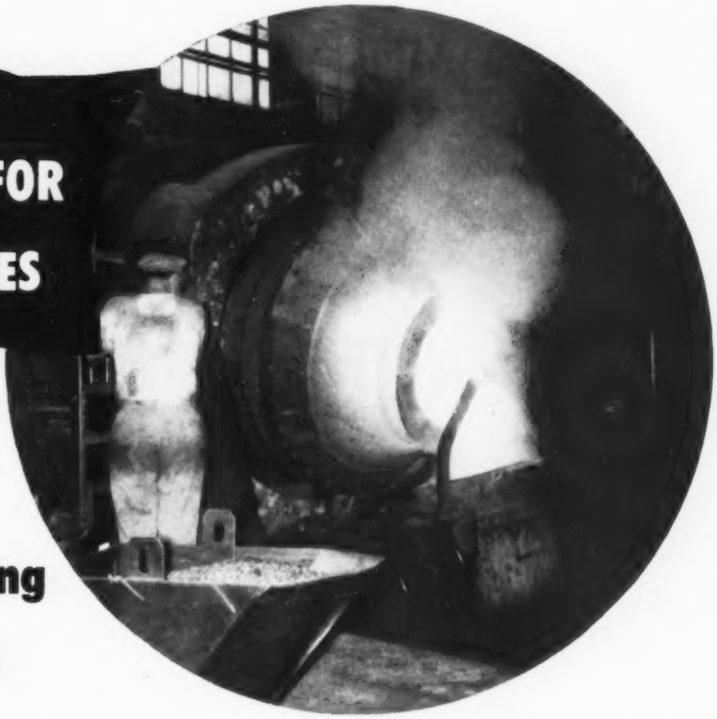
Fremont, Ohio

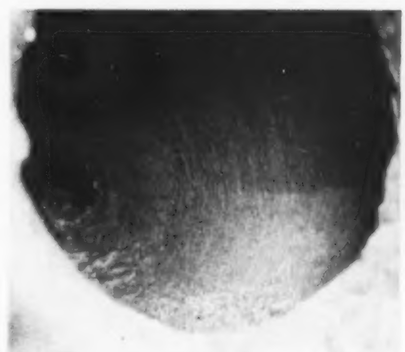
Everyone's busy at controls around this railroad. Chief Keokuk indicates that No. 999 is on time; Junior throws the switch; and Princess Wenatchee makes sure that signals are all in order.

Tasil LININGS FOR ROTARY FURNACES

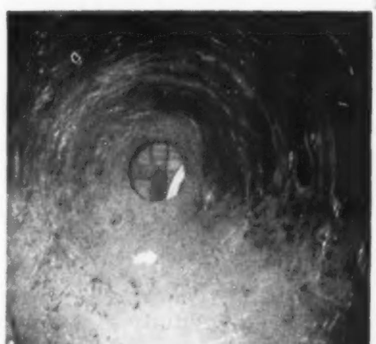


- **Last Longer**
- **Produce Less Slag**
- **Require Less Patching**
- **Increase Production**

The following performance report is based on the experience of a large producer of centrifugal castings, operating rotary furnaces lined with Taylor Sillimanite (TASIL) super-refractories. This modern foundry manufactures bushings, rolls, pump rotors, etc., for textile and pulp and paper industries. Furnaces are also used for the recovery of scrap, chips and turnings, cast into ingots. (See photographs at right.)



Photograph shows the TASIL brick and shape lining of a 2-ton rotary furnace *after three years* of intermittent service. Over 1,000,000 lbs. of monel and copper-nickel alloys were melted in this lining. There is no evidence of wear or joint erosion. The original 32″ inside diameter has been maintained.



This photograph shows the condition of a *fireclay brick lining* after 15 months service in a 5-ton rotary furnace operated by the same manufacturer, in the same foundry, as furnace in photo above. Approx. 730,000 lbs. of low melting point alloys were melted. Service of this furnace was less severe, as very few copper-nickel heats were melted. Note extreme slagging. Lining has lost 2″ to 3″ in vulnerable areas.

If your foundry is melting similar alloys in rotary furnaces, it will pay you to investigate this proven TASIL application. For detailed information, call your nearest Taylor representative or write direct.

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THAT MAKES THE **MULTI-WASH** *so efficient!*

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The cutaway diagram shows a type JC—2½ stage collector. Each impingement stage provides two washes of incoming dust-laden air, plus one at the bottom deflector plate, or five separate washes. This thorough scrubbing removes ordinary dust particles down to the two micron range, which drop to the sludge cone and then go to the dewatering tank.

For each impingement stage that is added, two extra washes are provided, increasing the efficiency and allowing the collection of finer particles down to sub-micron ranges.

It's easy to see why Multi-Wash is preferred by foundrymen who insist on the utmost in efficiency with lowest maintenance cost!

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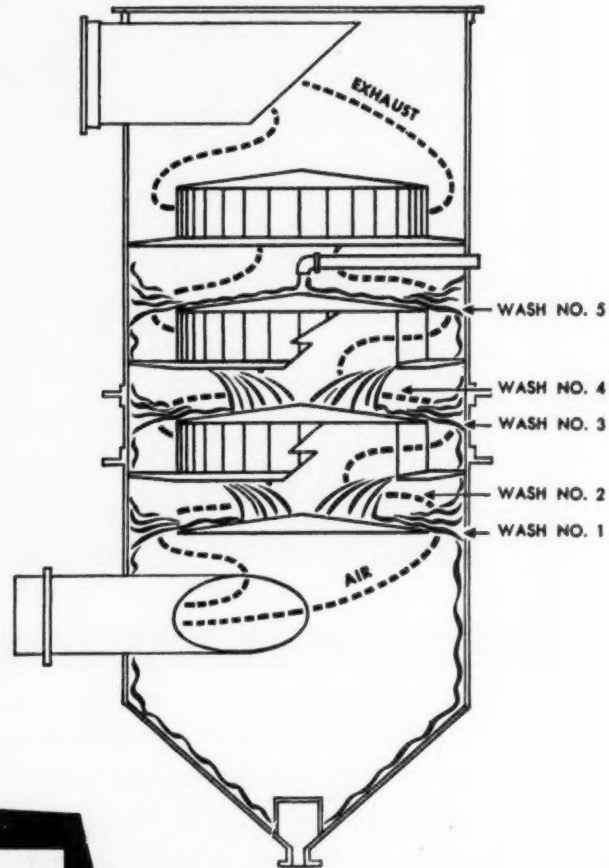
Cross-section diagram of type JC Multi-Wash collector showing 5 points of washing action. The type IC with 4½ impingement stages provides 9 washes while the HC with 6½ stages gives a total of 13 washes for removal of extremely fine particles.



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Editorial ★

The Foundry Industry in 1975 . . .

■ It's a little difficult for a foundryman to take a detached view of his own industry. But it's worth trying now and then to see where the industry stands today and what it might look like in the future. Further, it's essential to stand off and take a look at the industry's opportunities for development as James H. Smith has done in his Charles Edgar Hoyt Annual Lecture (pp. 42-47).

If the foundry expands along with other industry as predicted in the Paley Report . . . if foundrymen take advantage of their growing opportunities . . . what will our industry look like in 1975?

Foundries probably need not be any larger a quarter century from now because improved equipment for molding, coremaking and material handling will permit increased production in the same plant area. The increased activity per unit area could create more health and safety hazards . . . but this should not happen because foundrymen, even as they are gradually starting to do now, will use all the available devices for insuring clean air inside and outside, for reducing noise levels, for making the foundry a better place to work.

Molding and coremaking will be much closer to the push-button operation they are now approaching. Already one plant is using an almost fully automatic molding unit, manned by attendants whose primary job is to watch the machine work. The machine turns out 2000 molds a shift.

Traditional molding methods will be joined by shell molding, now a reality, and by high-pressure molding, which is well beyond the pilot stage. "Precision" will no longer be a relative term; all production molding procedures will give essentially the same accuracy in similar castings.

Green sand foundries will follow the trend toward finer sands in achieving better surface finish. Closer control of grain distribution will permit harder ramming without serious loss of permeability. Automatic control of pH and moisture in sand mixtures will give optimum mold properties with minimum moisture and binder. Closer dimensional control and superior surface finish will result.

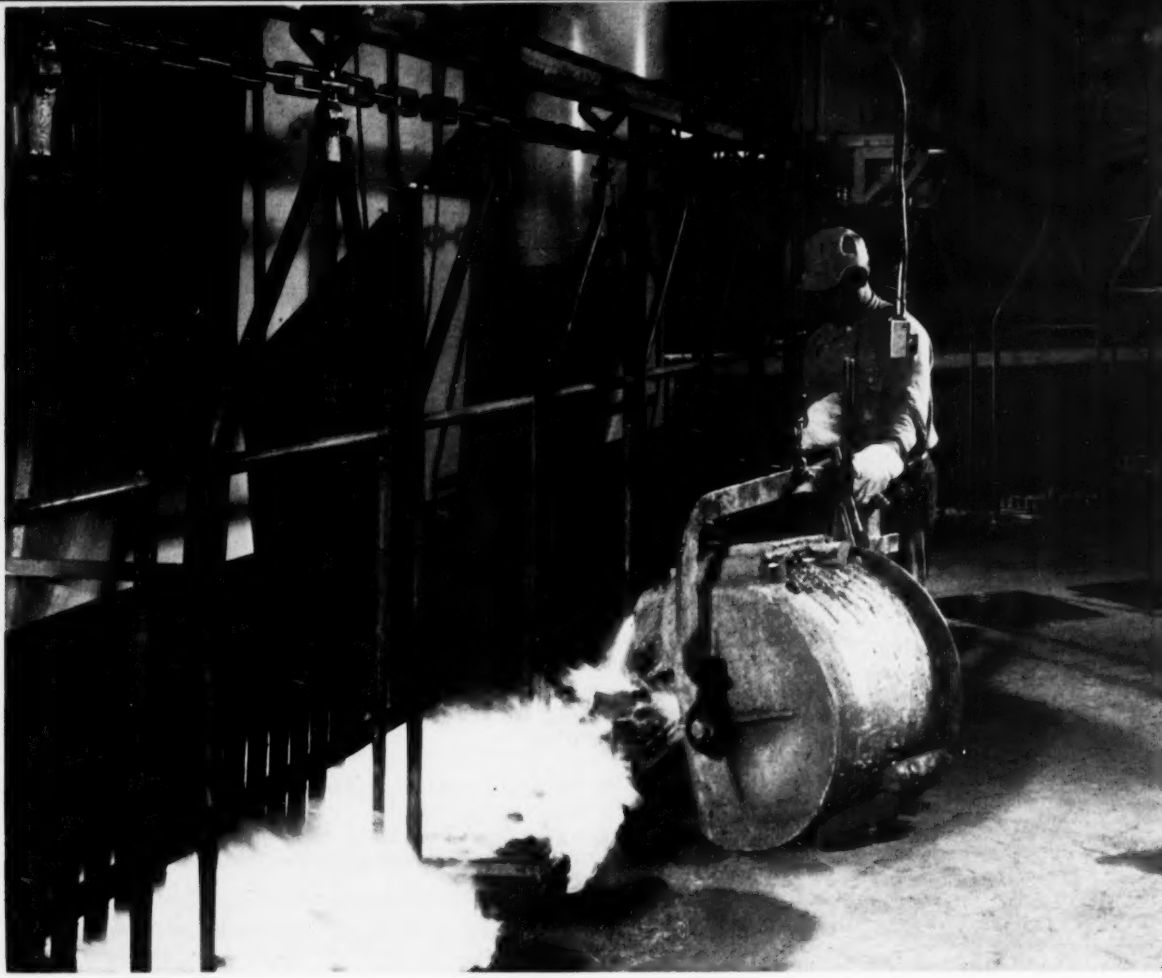
Old coremakers will have learned many a new trick by 1975. Some will be blowing cores in heated boxes to produce finished cores in seconds. While traditional coremaking methods will continue to be used, conventional blowing and baking equipment will also be used to produce heavy "shells" that can be assembled and poured without back-up material.

The science of solidification, which is only now beginning to be recognized, will be in common use in another quarter century, and will be a potent factor in the selection of mold materials, in gating, and in risering. Hydraulics of metal flow will be far better understood, science thus replacing much of the old-time "art" in gating practice.

The probable list of achievements of the foundry industry at the three-quarter-century mark is much longer and includes many remarkable developments in melting, alloying, mechanization and maintenance, personnel relations, and business procedures. The crystal ball hasn't yet been made that will reveal exactly where the castings industry will stand in 1975, but it is a safe bet the record will show we haven't been standing still. And for any foundryman, the next 25 years should be a mighty interesting period.

Collins L. Carter

President-Elect A.F.S.



Pouring shells on a continuous-type conveyor, where they remain for short cooling period.

Outstanding Opportunities For the Foundry Industry

James H. Smith / *Gen. Mgr., Central Foundry Div., Gen. Motors Corp., Saginaw, Mich.*

More new and interesting developments are available to the foundry industry, which can affect it economically, today than at any time in the past quarter-century, according to the 1953 Charles Edgar Hoyt lecturer. Engaged in foundry production or management since 1921, Mr. Smith has recently visited a number of foundries in this country and abroad where he has observed closely the trends of the industry. Here are his ideas on some of the trends which may revolutionize the foundry industry. The ideas pertain in large part to all branches of the industry though expressed in terms of ferrous metals.

This paper was the Charles Edgar Hoyt Annual Lecture, presented at the 1953 A.F.S. Convention.

■ Five particularly important opportunities stand out among many which present themselves to the foundry industry. These lie in the fields of:

1. Molding Methods and Materials.
2. Metallurgy of Cast Iron.
3. Heat Treatment of Cast Iron.
4. Methods Engineering.

5. Educational Programs for the Foundry Industry.

The foundryman has improved sand workability to achieve better molds, truer, cleaner, and more economical castings. He has obtained these results by better understanding of the materials used in the preparation of the sand and improved equipment for distribution and mulling of the clays.

New sand-conditioning resins for the foundry industry are now available and the next few years should see some very important developments which will improve conventional green-sand molding methods.

A new molding technique has been developed called pressure molding which utilizes pressures up to 500 psi as compared with pressures of 50 psi or less being used at the present time. This method produces a very smooth and accurate casting. Proponents of this molding method are very enthusiastic regarding the future of the process. I would not be surprised if, within a few months, some plants were in production, using these high-pressure molding machines with resin additives to the molding sand.

Resin Function

The function of these resin additives is to improve the workability of the sand through uniform clay distribution, eliminating any clay balls. The result is increased flowability of the sand with uniformly hard molds on both vertical and horizontal mold surfaces, producing castings needing a minimum of cleaning. The trend in molding-sand technique is definitely in the direction of reduced cleaning time and closer dimensional tolerances.

The shell molding and core-making process needs no introduction to you foundrymen. I consider the shell process one of the greatest technical developments of our time in the foundry industry. In my estimation, it may revolutionize foundry molding techniques to the point where it will be more economical to produce most small castings, and some large castings, by the shell-mold process as compared with conventional, green-sand molding.

Complete mechanization of the molding operation on high-production runs is possible using this process. Several machines which accomplish this are already on the market.

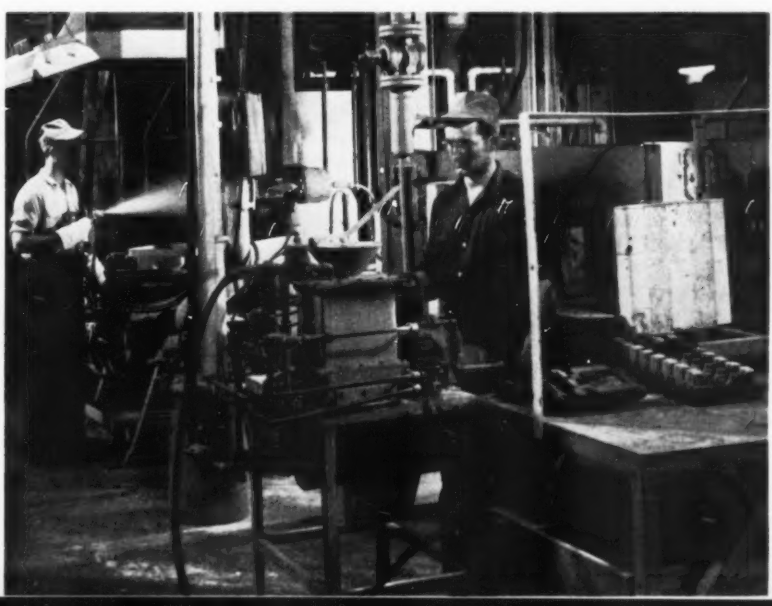
The shell process is usually considered a precision casting process. It is usually thought of as being between green-sand molding and the lost wax technique. At Central Foundry Division we are approaching the shell program from the standpoint of producing a better casting for less money and, at the same time, holding the dimensional tolerances to closer limits than with our present green-sand method. We are not promising tolerances to the degree where machining can be entirely eliminated. Some of the claims which have been made in published articles regarding tolerances have been very misleading. We know that it is possible to hold very close limits on castings made in experimental laboratories using laboratory methods, but we know also that the same results are very difficult to obtain in high-volume production, using practical manufacturing methods. There is every reason to believe that sometime in the future, as the technique is further developed, it will be possible to cast many surfaces to much closer dimensional tolerances.

Resin Cost a Drawback

The cost of the phenolic resins used to provide the bond material for the silica grains in the construction of the shell is the main reason for the process not being more widely used. There seems to be little chance of a reduction of the present high cost of phenolic resin because of the stable price of phenol. Manufacturers are striving to discover suitable resin substitutes and resin extenders. Our research laboratory has a continuous program to try to find a substitute for phenolic resin or a material which can be blended with phenolic resin to produce a less expensive mix. If it is possible to use a material which would bring the price of the bonding material down to 10¢ or 15¢ a pound, I believe most everyone would use the shell process for the production of small castings. Even at the present high resin cost, many castings can be produced at a cost comparable to green-sand molding. This is particularly true where cores can be eliminated by the use of the process.

(At this point, a motion picture of the shell process, was shown.)

At our Saginaw Malleable Iron Plant, where quite



Internal shell-making machine with baking oven located directly behind the operator, conserving movement.

New double core box setup, allowing steady production of cores. Operator can now remove filled core box from machine with one hand while inserting empty core box with other hand. Method upped production 42 percent.

a few castings are made in shell molds, we use a continuous pendulum-type conveyor with shell-making machines set parallel to the conveyor.

The shell-making machine is an integrated mechanism operating in cycles and consisting of a gas-fired, radiant-burner oven, a rollover box containing the sand-resin material, and the pattern mounted on a hinged arm. Adjacent to this machine is a vibrator-actuated container which holds dry resin used for gluing the shells together, a fixture for knocking out the top of the pouring sprue, and a jolt-squeeze machine which is used in the gluing operation to press the halves of the shell together.

At the start of the cycle, the hot patterns, both cope and drag, are lowered onto a rollover box which contains a sand resin material from which the shells are made. The rollover box and pattern are then inverted for about 20 seconds which is the approximate time needed for enough of the material to adhere to the hot pattern to make a shell about 5/16 of an inch thick.

When the shell is ready for curing, the rollover box returns to its original position. The shell and pattern mechanically enter the gas-fired, radiant-burner oven for curing. The amount of curing time will vary with the thickness of the shell—a shell 5/16 of an inch thick requires approximately 40 seconds.

Foresees Further Shell Mold Advances

After the shell is cured, the door of the oven rises and the mechanical arm carrying the pattern and shell moves to a vertical position parallel to the furnace door. Spring-loaded ejector pins release the shells from the pattern. The operator places the drag half on the gluing fixture, and the cope half is placed on the holder which knocks out the top of the pouring sprue. He positions the resin container which vibrates dry resin onto the shell and then places the cope half onto the drag half and touches the controls which automatically move the squeezehead of the gluing machine into position. The machine presses the halves together for a predetermined length of time sufficient to assure a firmly-bonded complete shell.

The completed shell is placed on the pendulum conveyor and moves to the pouring station. After being poured, the shells remain on the continuous conveyor for a short cooling period. When they arrive at the shakeout screen, a cam-actuated mechanism tips the conveyor plates, and the shell and castings are dumped onto the shakeout screen. The sand is vibrated through the screen, and the castings drop into a hopper below.

We are sure there will be further, rapid development in this interesting technique of making castings.

Metallurgy of Cast Iron

Most of the technical advancement in the ferrous industry during the past century, with the exception of recent years, has been in steel; very little progress was made in the development of cast iron. Recently, engineers and metallurgists working together have

made wonderful strides in cast iron metallurgy, in developing new alloys and in improving melting techniques.

One of the developments of this period of research is nodular iron. This product is frequently made by adding magnesium or magnesium alloys to gray iron, which changes the graphite form on solidification from flake to some other pattern, preferably to a round shape similar to that of temper carbon in malleable iron.

A realistic evaluation of the market for this type of iron indicates that it has a wide range of potential engineering applications. The product will have a much larger market if and when it is possible to produce it more economically and with more uniform results. To accomplish this, it is possible that it may be necessary to find a method of making this or similar products in the cupola or some other melting medium. Continuing research is being conducted in this country and abroad, and there is every reason to believe that in the future nodular iron will assume a much more competitive role.

Low-sulphur Gray Iron

Another development, which will definitely have a marked effect on the iron casting industry, is the production of a low-sulphur gray iron. To produce this, molten cupola iron is treated with finely divided particles of calcium carbide. The product possesses superior mechanical properties with a tensile value approaching 50,000 psi and with a Brinell hardness of around 200.

If it has the proper analysis, the calcium carbide-treated metal, with the addition of magnesium oxides, can be used to produce nodular iron; other nodularizing agents, such as rare earth oxides have also been used successfully with this base metal in producing nodular iron.

Comparatively little of this low-sulphur iron has been produced on a production basis; but, no doubt, there will be an increasing demand in the future providing the product can be produced economically.

Development of Pearlitic Malleable

Another cast iron which has been developed in recent years is pearlitic malleable iron. In our plants we make this iron by using the regular base white iron which is melted in a cupola and superheated in an electric furnace. The castings are then malleablized in a continuous, radiant-tube, gas-fired, heat-treating furnace . . . quenched in air at about 1650 F . . . and tempered back to the desired hardness.

During the past fifteen years the use of this product has increased from practically nothing to about 100,000 tons per year. The product has found wide application in the automotive field and particularly in automatic transmissions. It is also used effectively for household appliance parts, diesel engine parts, hand tools, and many other uses. The contribution of this engineering material to the small arms, military truck and ammunition programs during World War II and in the present Korean conflict has been substantial. The future of pearlitic malleable looks very promising; it is constantly replacing forged steel parts, weldments, and stampings.

Heavy-Section Malleable

Another development of the last few years is a product called "bisbo" iron, which was developed in General Motors' research laboratory. This iron is made by adding small amounts of bismuth and boron to white iron base metal and malleablizing to make a pearlitic structure. The purpose of the alloy additions is to prevent formation of graphite on solidification in heavy section castings. Previously, malleable iron castings have been cast in relatively light sections, generally less than 1½ inches. Castings are now being produced in sections up to 4 inches and free from primary graphite. Since this type of iron can be produced from a standard white iron base metal, it has many possibilities; therefore I can visualize a considerable tonnage of castings with heavy sections being made from this material.

The trend of the designing engineers in the automotive and allied fields is toward more intricate castings with thinner walls. How is the foundryman going to meet this challenge? The most logical way is to be able to pour iron into the mold at a uniformly higher temperature than is being done at present. This can be accomplished by a duplex melting operation, melting down in the cupola and superheating to a constant temperature in an electric furnace. We are about to start this practice in the gray iron foundry where we are making automotive and diesel engine cylinder blocks and heads. We believe that the improvement in metal and temperature control will more than justify the added cost and make it possible for us to meet the evergrowing demand for lighter section castings.

Micro-Chemistry in Infancy

An outstanding development in melting practice in recent years has been the increased use of basic-lined cupolas. To produce some of the new irons which we have been discussing, it appears that basic-lined cupolas will be more widely used as the new irons come into greater demand.

The metallurgical developments of the past few years in the foundry industry have been little short of miraculous. It is difficult to visualize the tremendous effect that minute percentages of certain elements have on the molecular structure and physical properties of iron. The use of micro-chemistry in the foundry industry is in its infancy. The control and effects of small amounts of various elements will play an important role in foundry metallurgy, possibly to even a greater extent than has been witnessed during the past few decades in the steel industry.

The new products which have been the results of these development programs have had a tremendous effect on the economy of the country. They have made it possible for the manufacturers of many items, such as automobiles, household appliances, farm equipment, diesel engines and many others to make a better product at a lower cost. I am sure that with all of the new things on which we are working and with developments of the future we will have the opportunity and will continue to make a substantial contribution to the over-all economy of our country.

Much research work has been conducted in recent years on the heat treatment of various types of iron. Maximum uniformity of structure is always important and is one of the benefits derived from heat treatment. Several of the heat treatments for cast iron which will be used increasingly in the next few years are:

Annealing for Stress Relief definitely increases the life of large and highly-stressed gray iron parts. It is used to a great extent for diesel engine cylinder blocks and heads and similar parts. The temperature used must be kept below the critical, with the temperature and time depending upon the size and form of the castings.

Annealing for Machinability. I believe this type of heat treatment for many gray iron castings will increase extremely rapidly in the next few years. In one of our gray iron foundries, over 80 per cent of the production is annealed for machinability with a resultant increase in the machine shop of 25 to 50 per cent in the output per machine and an increase in tool life of over 100 per cent. This method of annealing is called microstructural control to produce a ferritic matrix. How can any cost-minded management miss this opportunity of cost saving wherever machinability is of prime consideration! For most gray iron castings, an hour at 1350 to 1550 F, depending upon the chemistry of the castings, will produce the desired results.

Quenching for Higher Strength. This type of heat treatment will gain much wider use, as time goes on, due to the fact that there is an increasing demand for higher strength irons. By heating to approximately 1600 F and quenching in oil, followed by a subsequent draw, 60,000 to 80,000 psi tensile irons can be produced. The heating temperature may vary in relation to the chemistry of the iron.

Martempering. This is a relatively new method of heat treatment for castings. Castings are quenched rapidly from above the critical by submerging in a liquid bath and holding at a temperature of about 400 to 500 F. Castings are held in the bath only until they have reached the same temperature as the quenching medium and are then withdrawn and cooled in air. In some instances, a subsequent low-temperature draw is used to further reduce any tendency toward cracking, particularly if the casting shape is intricate. This treatment has been used on a number of finish-machined, pearlitic malleable iron castings with the advantage of minimizing internal strains and preventing warpage. This method will find an increasing number of applications in the future.

Heat treatment is somewhat new for many foundrymen. When they realize the advantages to be gained in increased physical properties and the marked improvement in machining characteristics, I am certain there will be a very decided increase in the heat treatment of iron castings. Certainly there are enough possibilities in this phase of our business to consider it an outstanding opportunity for the future.

Methods Engineering Increases Efficiency

Methods engineering is the analyzing and planning of employee movements to increase their effectiveness. This means the elimination of idle time, the reduction of ineffective movements, such as long body bends, turns, walking, heavy lifting and others. An analysis is also made to determine the advisability of combining operations.

This analyzing and planning not only improves quality and reduces cost, it improves working conditions, relieves monotony and fatigue and results in a much more satisfied and efficient employe. With this accomplished, we are a much better competitor in a highly competitive market which requires a constant effort to provide the customer with a better quality product at lower cost.

For a methods program to be effective and successful requires the full support and cooperation of the entire management group. This is a continuing activity as today's improvements may be obsolete tomorrow because new ideas and technological improvements progressively change our thinking.

[At this point, a short film entitled *"Methods Engineering as Applied to the Foundry Industry"* was shown. Some of the illustrations show what has been achieved through methods engineering.]

Methods engineering is valuable in any industry, regardless of size or kind, and provides an excellent way to realize enormous returns from the time and effort spent. In my opinion, we have only scratched the surface of the unlimited opportunities in methods engineering in the foundry industry.

Foundry Educational Programs

We all know that men and materials are important, and up to this point we have discussed the material and process aspects of foundry opportunities. Machinery and raw material, being on the open market, are available to anyone with the purchasing power to acquire them. What then, makes some organizations more successful than others? It is their greatest asset—people. People of many types and talents make up our entire organization.

During the past few decades, the foundry industry has actively solicited men in the engineering fields in increasing numbers and has used them to good advantage in all phases of the business. As foundrymen, we look toward the engineer for technical and industrial progress.

As I mention engineers, the thought no doubt comes to your mind that I am advocating running all of our plants with engineers or trained technical men. I have no such thought and certainly want that point made clear. The people we have in the industry today are doing and will continue to do a good job. Our objective, however, should not be to do as good as we have—but to improve our position. This means that we must concentrate on training our organization for the present and the future.

The graduating engineer is rarely in a position to make an immediate contribution to the industry or assume the responsibilities of management. He does, in most cases, have a potential greater than had he not had the benefit of this formal education. The trend in the foundry industry is toward the employment of the technical graduate for future positions of responsibility in manufacturing.

In order to interest engineering students in the Foundry Industry, we should do three things: (1) Develop methods to influence students who will one day be specifying and using cast metal products; (2)

Endeavor to influence engineering students to enter the foundry sequence in schools where such a program is available; and (3) Concentrate on making the foundry sequence available in more schools and universities.

Although the engineering enrollments are seriously low, more engineering graduates have entered the foundry industry in the past year than in previous years; however, we still are not getting our share of the graduating engineering talent. Of last year's class, less than 1 per cent chose for their career the fifth largest durable goods industry in the country. There can be only one answer—they do not realize the opportunity the foundry industry has to offer! And, until the last two or three years, we have done little to let them know of these opportunities.

The Foundry Educational Foundation is aggressively tackling this problem. Since the Foundation was incorporated in February of 1947, a total of 990 graduates have entered the foundry industry through the FEF program, and approximately 1,450 students were employed as summer workers. This organization is doing, and I believe will continue to do, an excellent job in furnishing the foundry industry with young men schooled in the fundamentals of foundry engineering. However, they can supply the industry with only a limited number of these people. We must recruit all available talent possible from the graduating classes of the engineering schools to get the additional technical people we will need.

Suggestions

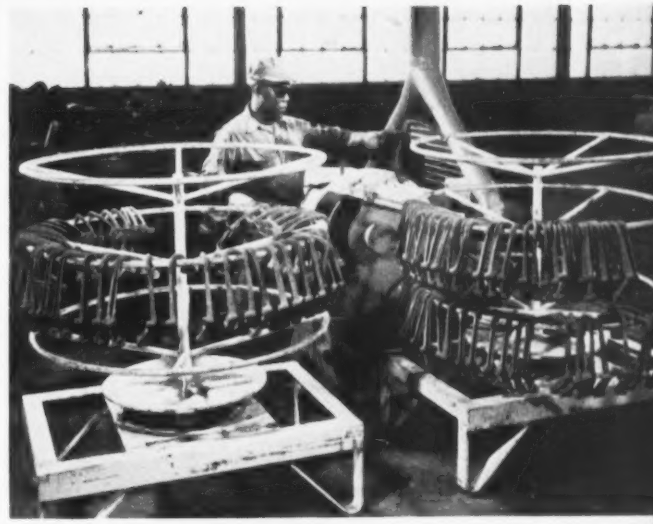
Here are six suggestions which I think will help us attain higher caliber and better-trained organizations:

1. Set up better procedures to select qualified personnel for supervisory positions. This would include selections from within our own organizations as well as new hires.
2. Provide good, workable training programs for all supervisors and technical personnel.
3. Maintain effective apprentice programs to develop the skilled trades necessary, such as patternmakers, tool and die makers, millwrights, electricians, etc.
4. Acquaint more students in the engineering schools with the opportunities in the foundry industry by getting the schools to include foundry educational programs as a part of their curriculum.
5. Try to attract more graduate engineers into the industry to accelerate the development work necessary to keep abreast of competing industries.
6. Support the Foundry Educational Foundation financially.

Certainly it would not be necessary to replace any management employes in the industry to accomplish what I propose. Every year there are in excess of 2,000 supervisors, engineers or others in the management group who leave the industry through retirement, death and for other reasons. Concentrating on better training and placement would certainly tend to improve our organizations tremendously.

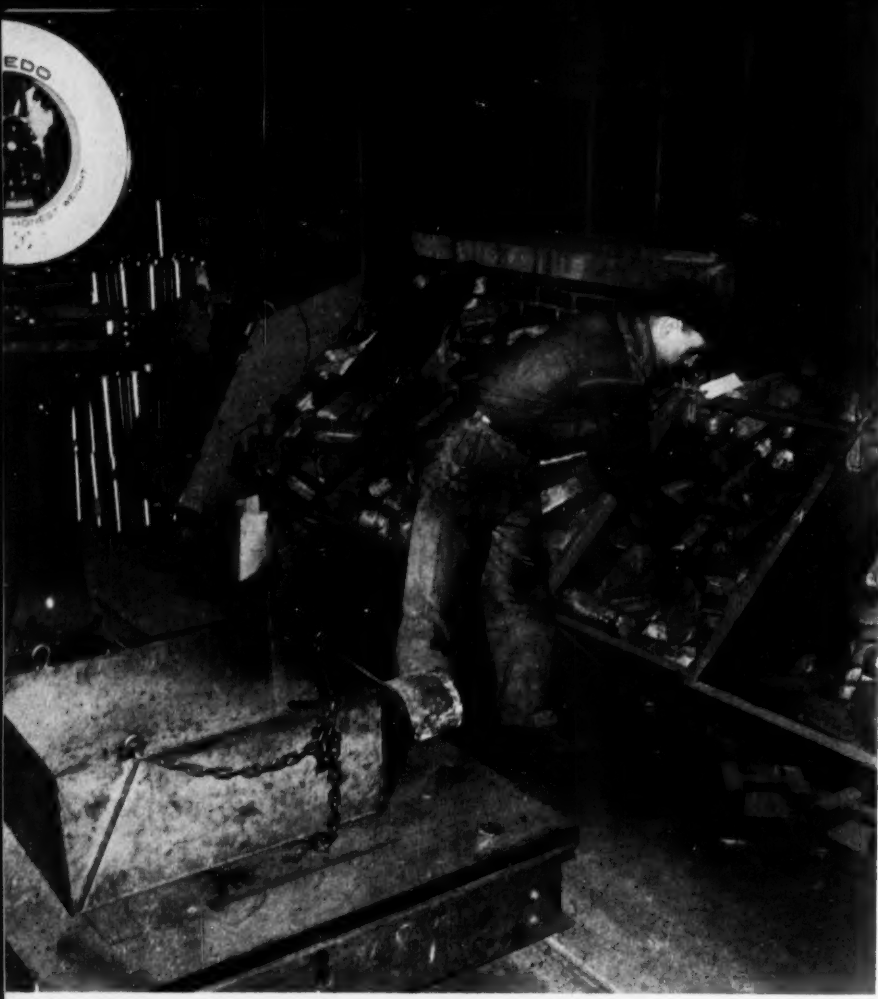
I believe that there are unlimited opportunities for improved educational programs for the Foundry Industry, and I would like to emphasize that unless we develop more and better-trained people, we will not receive the maximum benefits from the other opportunities we have been discussing.

I look forward with a great deal of optimism to the future. In our hands lie outstanding opportunities for the foundry industry. This great industry of ours in future years will have engineering markets and stature in the economy of America in direct proportion to what we men in the industry today do in the years immediately ahead of us. We have been told that the future of the foundry industry is bright, but it can only be so as a reflection of our own endeavor. This responsibility is entirely ours, both individually and collectively! If we meet these responsibilities and take advantage of our opportunities, we cannot help being successful in this interesting and dramatic business.



After annealing, foot pedals are placed on portable, rotating rack by operator, who grinds and disposes to other rack. Method eliminates fatiguing body movements.

This improved method of shearing gates and shot blasting differential carriers has eliminated two operators and necessity of trucking between the various operations.



". . . one of the main things . . . is to sell the proper alloy to the customer and keep that alloy within certain broad specifications . . ."

A.F. ROUND TABLE

Non-Ferrous Melting—Working Tips and Ideas

FOR another of its Round Table meetings, AMERICAN FOUNDRYMAN invited six non-ferrous foundrymen from Texas and Oklahoma to discuss melting of copper-base and light metal alloys. Participating in this practical discussion were: John M. Bird, American Brass Foundry, Ft. Worth—chairman; Jake Dee, Dee Brass Foundry, Houston; Dan A. Mitchell, Progessive Brass Mfg. Co., Tulsa, Okla.; J. G. Winget, Reda Pump Co., Bartleville, Okla.; John G. Collier, Garrot Brass & Machine Co., Houston; and W. G. Coley, Longview Brass & Aluminum Co., Longview, Texas. Here are their ideas based on years of experience in operating and managing non-ferrous shops.

Jake Dee: One of the most important operations in a foundry is the melting of metal. At times a foundryman spends hours making a good clean mold with gating, venting, and sand correct. Then he spends very little time with the metal. He doesn't check to see that the furnace is operating efficiently or whether it is gassing, throws a few hundred pounds of ingots in the crucible, melts it, pulls it out, checks it, pours the mold, and winds up with a bad casting.

If the average foundryman will think of his furnace before any other part of the foundry . . . see that the gas and air are properly distributed . . . that the lining's in good shape . . . the burners are operating right

. . . furnace cover is not too large so it is throwing flame out of the furnace instead of into the furnace . . . then we would get better results, save money and operate more efficiently.

Dan Mitchell: We check our crucible furnaces periodically, to see whether we have an oxidizing flame or a reducing flame. The men are trained so that they can pretty well tell what kind of a flame they're getting. They use the old standard test using a piece of zinc.

John M. Bird: You have reference to 85-three 5's or to all non-ferrous metals?

Mitchell: As far as the atmosphere of the furnace is concerned, I don't think it makes any difference what alloy it is. I believe your money is made or lost many times right in the furnace room. And in pouring several different alloys, if you don't have your men trained to get the right alloy—if they mix up some 88-10-2 with some 85-5-5-5—they are not giving the customer the metal he's asking for.

John G. Collier: I'd like to get down to cases. You melt under slightly oxidizing conditions all the time according to one practice that's followed. Some people melt under reducing conditions. Our standard practice is to melt slightly oxidizing. We melt in oil-fired furnaces, figuring that we have less chance of getting an incorrect mixture when using oil. It doesn't change quite as fast as gas: adjustments required are not quite so delicate.

Hydrogen is a bugaboo—hydrogen is more predominant in a reducing atmosphere in your furnace, a situation to keep away from under most circumstances. Stay on the slightly oxidizing side, and when you're ready to come out of the furnace deoxidize with phos copper. Allow say, a five-minute dwell period before you pour.

Dee: Say your furnace wears down to where you have only an inch of lining, four or five inches space between the lining and crucible, and the crucible is six or seven inches below the cover; your flame isn't distributed evenly, and you burn a hole that's way out of proportion. I don't care what kind of flame you use, or what kind of test you give a furnace like that, you're not going to get a good heat, unless it's by accident.

How many of us know how much gas goes into a furnace? We guess at it. We can control the air because we know that the blower puts out, but nobody knows how much gas you get out of one unless you actually test it.

W. G. Coley: I use a pit furnace and natural gas. I heartily agree on the furnace lining. Not only do I use an oxidizing flame but I go by the way it sounds. As the furnace lining burns out, if the crucible is too low, or if it is too close to your lid, you get a different sound. I also figure the quicker I can get a heat of brass out the better off I am.

Dee: Our furnaces used to take an hour and a half to melt a heat. By checking the lining and fixing the burner hole, we get the same heats out in 40 minutes.

J. G. Winget: *"In other words, if you come out of the furnace with a gassy metal, you'd better hold the temperature somewhat on the low side."*

It makes a lot of difference, keeping the furnace in good shape.

Winget: Our crucible furnaces are used primarily now for heating crucibles for pouring. But everything that's been said about an oxidizing atmosphere in a crucible furnace, I'll agree with 100 per cent. By the same token you can melt just as good metal under a slightly reducing atmosphere. In my opinion there's a lot of difference in the degree of oxidizing or the degree of reducing atmosphere, and I don't think that there's much excuse today for any foundry to be running too far either way. One of the big oil companies has an instrument available to every foundry free of charge, for checking furnaces. You get a direct reading. It takes only about as long as it does by the old zinc method but you know exactly the percentage of excess gas or excess oxygen you've got in your furnace.

I'd like to say something about melters. I've been in about 100 foundries over the country in the past two years and my observation is that the melter actually has more to do with the quality of the product than anyone else.

Dee: I'm sure glad you brought that up. I've been preaching for some 20 years that the furnace man has the most important job in the foundry.

Bird: Do you have to check your flame in a reverberatory furnace?

Winget: Absolutely. Just as you do in any other type. I think I can say unequivocally that it's impossible to melt a successful heat of bronze in a stack-charging,

John G. Collier *(left): "Some people melt under reducing conditions. Our standard practice is to melt slightly oxidizing."* **W. G. Coley** *(right): "I use some scrap, but not any kind. I get it from customers who want it right back in castings."*

reverberatory furnace under an oxidizing atmosphere. By the same token, you shouldn't go too far on the reducing side. We've run ours up to 10 to 12 per cent reducing just to see what it would do. If we're between 2 to 5 per cent reducing we get wonderful results and good melting economy. But you can go just as far off with one of those furnaces—and a heck of a lot quicker—than you can with a crucible furnace, because you're melting about six times as fast.

Bird: Because the terms are sometimes misused, I believe we ought to have a definition of *reducing* and *oxidizing*.

Winget: It takes a certain amount of oxygen to burn a given amount of fuel. If you're adding more air than is required, you have an oxidizing atmosphere. If you're adding so much fuel that the oxygen going into the furnace isn't sufficient to completely burn that fuel, you're on the reducing side. With an oxidizing flame you run high in carbon dioxide in the exhaust gases. With a reducing flame you run high in carbon monoxide.

All during the time that I've grown up in the foundry industry until about two years ago, without exception, you would practically have been thrown out of a meeting if you mentioned anything but a slightly oxidizing atmosphere. They weren't taking into consideration anything else such as the time element. I'd never heard a speaker talk about furnace atmosphere in relation to time of exposure of the metal.

Bird: Does it take as much skill to operate a reverberatory furnace, as a crucible furnace?

Mitchell: Well, I think it has to be watched a little bit closer because of the speed of melting. We put 460 lb of metal in our reverberatory and are ready to pour in 15 minutes, sometimes have two crucibles of metal poured in fifteen minutes. In a crucible type furnace, we take off a heat of 230 lb in 40 to 45 minutes. I think it takes a certain amount of skill to operate any type furnace.

Dee: We clean our furnaces in the morning and every Saturday we spend all day patching and cleaning the furnaces. When the lining gets bad we throw it out, regardless of how long it's been in—a week, a month, or a year. We don't take any chances, and it has paid us dividends. We have traced every trouble we've had with gassed metal to either bad lining or the furnace man being asleep on the job.

Coley: Do you think that it's the shape of your furnace that causes your metal to become gassed?

Dee: Well, I was blaming 90 per cent of the trouble on the furnaces because we can control our sand. When you melt a heat of brass, you don't know how that heat is until you pour it. You can test it, you can look at it, but you never know whether it's gassed until you pour it into the mold and pour a test coupon.

Collier: I contend you can take many more liberties with the mold than you can with the metal. For instance, you have a furnace lining that is flame-eroded, cracked, checked, and so forth. The furnace cover is in bad shape. Your flame takes a different path around the furnace and if the crucible is too far away from the top, the flame will come up and then down into your metal. This starts the metal whirling around, which is bad.

We use No. 80 crucible, pit-type furnaces, and our flame goes one and a half times around before it starts out the cover. If our crucible clears the cover by about 2 inches, most of that flame will come out of the hole in the cover and we won't have any impingement down on our metal. If you keep your crucible high enough the flame won't come down and touch the metal even though the lining is getting to where it needs to be replaced.

Dee: Don't blame the furnace alone, the crucibles have to be in good shape too.

Winget: In a stack-charged reverberatory with a lining that's slagged up, you're in trouble because the

only slag that you get is actually oxidized metal. If you're melting under a reducing atmosphere you don't get a slag buildup.

I think John Collier hit on something that actually controls the degree of contamination of the metal more than anything else—raising the crucible up to get the proper clearance between the top of the crucible and the top of the furnace. The reverberatory furnace operates under a back pressure, the theory being based on observing crucible furnaces for years. The crucible furnace operates under a definite back pressure, too. I don't think that the diameter of the lining in relation to the crucible is nearly as important as the area you have for the flame to get out at the top. You can control it either by choking off between the top of the crucible and the top of the furnace, or choking the charging hole itself.

You can check the back pressure easily (with anything but a positive pressure blower) with the average centrifugal blower that most furnaces have. Light the furnace and leave the lid open and you'll find the blower motor pulling about 50 per cent more amperes than if you close the lid. As your furnace comes up to temperature your amperage keeps dropping down. Time or two with crucible furnaces I've been caught without a lid and the hole burned out. Raising the height of block so that the crucible does the choking off, creates back pressure and you can bring your speed back up. You can do the same by putting a brick or two across the top.

Bird: Since we've got the furnaces all lined up now, let's start melting some metal.

Collier: I read in the magazines that experts from the metal companies say, "Of course you can't melt silicon bronze like you do 85-5-5-5." I melt them both the same.

Dee: Frankly, I thing if your furnace is in good shape, whether it's a reverberatory or crucible, and all your conditions are just right, you can melt any alloy. Of course, you have to pour at a different temperature according to your castings, and you can't contaminate one alloy with another in the same crucible.

Coley: I pour a considerable amount of 80-10-10, and it sweats lead occasionally, depending on the size of the casting. I pour it as cold as I can, the colder the less sweating.

Mitchell: We've never experienced it with 80-10-10, but we have with 24 per cent lead. A small percentage of nickel seemed to give the matrix a tendency to trap the globules of lead and keep it from sweating.

Winget: I have had sweating but never on 80-10-10. I've had it on a special impellor bronze, and I can say without reservation that in that particular alloy it's caused by nothing but gas. Metal temperature might have something to do with it, but I very firmly believe that if you've got the gas in the metal down to a minimum you're not going to have any lead sweating.

Mitchell: I've seen tin sweat just like lead. On high tin bronzes, like 88-10-2, I think it's caused by gas in the metal. The high tin bronze family is more apt to gas than 85-5-5-5 or 83-7-7-3.

Collier: We expect to pay more attention to 80-10-10 or a higher lead bronze like 18 per cent or higher. We generally resort to cuprous oxide, made up in a flux with glass and a silicon compound, to make certain that we have an oxidizing condition in our furnace during melting. We deoxidize with phos copper and generally we have experienced quite a low loss.

Dee: The 80-10-10 family is made up of bearing bronzes, and you very seldom make a light or thin-section casting out of 80-10-10. Most of the castings are heavy, so we always go to a coarse sand to vent the gases off. We try to avoid penetration as much as possible, and we watch the pouring temperature, of course.

Mitchell: We pour 88-10-2, 80-10-10, 85-5-5-5, and 83-7-7-3 all day long. If you've got good melting practice I don't think it makes a bit of difference what you pour, you're not going to have any trouble as far as gassy metal is concerned. I don't think you have to adjust your fire especially for each of these alloys.

Bird: I was hoping you'd bring out whether to attribute lead sweating or penetration to gassy metal. I don't think we should. Take a casting of 80-10-10 which sweats lead—something it shouldn't under normal conditions. Where should you look for the answer—the furnace or in the mold?

Dee: Well, I would look for it in the furnace. I have seen foundrymen, including myself when I didn't know any better, just buy copper scrap from the junk yard, secondary scrap, never check it for iron or anything else, as long as it's copper. The same thing goes for secondhand lead. Take such metals and try to make

Jake Dee: *"How many . . . know how much gas goes into a furnace? We guess at it . . ."*

Dan Mitchell: *"I believe your money is made or lost many times right in the furnace room. . . ."*

a high-lead alloy. You just can't do it, you have to alloy the metals properly before you ever put them into a mold.

Collier: We depend on the smelter to give us properly alloyed metal. So how can you explain, other than humidity differences, or maybe careless furnace practice, that every so often you get a heat or two of gassy leaded alloy?

Dee: If you are buying your metal in carload lots or say five-ton lots, and out of five tons of metal you get one or two bad heats, what are you going to blame it on? Nothing else but furnace practice.

The smelters have contributed a lot to the foundry industry. Before we had controlled metals, we really had trouble. We are very fortunate in having good smelters with good control like we have now; you really have to take your hat off to them. They take all our problems away from us and leave us only one thing, our furnace—and we neglect that.

Coley: I use some scrap but not any kind of scrap. I get it from customers who want it right back in castings. Oil in scrap will come as near gassing metal as anything so I keep my eyes open for it.

Getting back to something John Collier said a few minutes ago about the flame coming up a certain distance on his furnace, an irregular lining, one that has been burned out, naturally requires more gas to get the flame to come up. I definitely think furnace linings and the dimensions of the crucible and all come nearer to contaminating the metal than any other thing.

Winget: Sure, because the average furnace has a blower that's just the right capacity for a given lining. If the blower doesn't have excess capacity, when the lining goes out your melting economics are going to be bad. You have more gas but haven't enough air to compensate for that extra gas so that you can maintain the customary atmosphere. You are going to be wasting some gas. That's the crux of a lot of people's trouble—when the lining burns out they add more gas without adding more air.

If they were operating right to begin with, with crucible furnace atmosphere slightly oxidizing, they're asking for trouble by adding more gas because they're definitely going to be over on the reducing side. If there's enough excess capacity in the blower to add more air to keep the atmosphere in balance, you can still come out of a furnace with a badly eroded lining with a heat of metal that isn't gassed.

Collier: Every time we replace a lining, and sometimes in between, we clean and swab down the pipe that comes from the blower clear on down where it makes the crook to go into the furnace. We fire with oil which builds up a slight fuzz in there that may restrict the air flow. We pay particular attention to see that all the air passages are clean, burner nozzles are clean and sharp, and that the burner tunnel into the furnace is small. This insures that when you get the proper amount of air, you don't dissipate it before it gets a chance to mix with the fuel and the atomized fuel. Take care of these things and pay particular attention to the pressure on the pump coming down to the nozzle and you can't help but get a pretty hot flame.

Winget: I was recently called into a shop that was having all kinds of trouble with an oil-fired furnace. Believe it or not, every bit of trouble was caused by a little tiny pimple that wasn't an eighth of an inch high and just about an eighth of an inch in diameter. It was breaking up the air and oil flow. We smoothed it out and the furnace operated perfectly.

Collier: The flame is pretty hot down close to that nozzle and it will melt slag along with whatever sand is carried in on the bottom of the crucible. This will build up from the slightest projection on the side of the furnace just like a little snow bank.

Dee: Going back quite a few years, we used only open flame furnaces, and we didn't have gas problems that I know of. Maybe I wasn't watching the metal close enough, though we got out awfully good metal. You could nickelplate all types of castings.

Then we got into crucible melting. Now we think that we can't get a decent heat out without a crucible although I've always favored an open flame furnace.

Collier: We use a rotary and we can get just as good metal out of it as out of the crucible.

Mitchell: In any kind of furnace, combustion control is important. Checking furnaces with a piece of zinc is reasonably satisfactory but any instrument that's made to check gasses would be best. You can't tell by your eye. We have checked. You'll get a nice green

flame and think you've got oxidizing conditions; you actually may have a reducing condition.

Dee: We use the zinc test and have very good results. It is the cheapest and the fastest method we have and it has been used for years and years. We keep a box full of little zinc blocks by our furnace for that purpose. It doesn't make any difference what type as long as it's slab zinc broken into little pieces. Pick up a nice shiny piece with a pair of tongs, and put it over your furnace for a few seconds, and you can very well tell how your furnace is acting.

Bird: Someone mentioned a while ago about atmospheric condition having something to do with the metal.

Mitchell: If you're trying to get pressure-tight aluminum castings and you pour when there is a lot of moisture in the air, you will definitely have more leakers than on a dry day. Whether that would hold true of bronzes, I don't know.

Winget: I have a theory on that; I'd like somebody who's got some energy to try it sometime. On days the atmosphere is heavy and wet, we have often run into gas, particularly in aluminum. I have often wondered if that wasn't caused by the fact that there is less oxygen in the same amount of air used for combustion. In other words, you're throwing more air through your blower on a dry day than you are on a damp day. The same thing happens in a furnace where the metal is preheated before it goes in the melting zone, unless you make a correction in your blower for the moisture in the atmosphere.

Coley: You have to be as particular with the furnace on the lighter metals as you do on the red metals, especially on damp days. Before I started using a filter on my blower, I was getting considerable leakage on damp days.

Mitchell: In this discussion, we're assuming that if you get gassy metal it all comes from the furnace. I think you can get gassy metal after you get the metal clear out of the furnace.

Winget: Back in the days when we were making aluminum pressure castings, we had to give more attention to the melting, and the handling of aluminum after it came out of the furnace, by far than we did with red brass, bronze, or silicon bronze.

Dee: I find that aluminum is a little more difficult than brass. But if the furnace condition is right, it isn't too bad. We find that by heating the furnace and the ingots before charging, then watching the metal temperature so you don't let it soak too long, you get good results.

By holding the lip of the crucible too far from the mold when you pour, you can pick up a lot of air in

John M. Bird: *"Because the terms are sometimes misused, . . . we ought to have a definition of reducing and oxidizing for uniformity in discussion."*

pouring. I think you have to control aluminum a little more carefully than you do brass. Also you can't use all grades of aluminum for pressure. Certain alloys will hold pressure and certain alloys won't.

We try to stay in a range around 1350 F for pressure casting on all aluminum alloys. That's a medium temperature, I'd say. A little on the high side for heavy casting but, if you're going to hold pressure, you have to pour hot enough to feed the castings.

Collier: I don't think you have to take more care with aluminum than you do with the red metals. Furnace practice on all metals is critical. Your furnaceman can give you a bad heat of red metal just as easily as he can give you a bad heat of light metal. We generally flux our aluminum.

As far as handling pressure castings, I think the type of metal that you buy has a lot to do with it. We noticed the difference between two particular ingot suppliers. One will carry, I suppose, a higher gas content than the other. If we have a gating system that works with one metal, say with a higher gas content in it, that particular gating system with all the other conditions the same, will not work on the metal with the lower gas content. We'll have shrinkage.

Mitchell: I think aluminum is a tricky metal, but you watch every guy that starts up a foundry in a chickenhouse or somewhere like that and he starts pouring aluminum.

Dee: One of the reasons is, they don't make pressure castings, just ordinary castings. Now as to fluxing, we use a dry flux, but I'd like to use chlorine gas. Right now we're not set up for it, but I think it's best on certain alloys. We use a dry flux because it's the easiest to use and we have good results with it.

Aluminum is the trickiest metal outside of alumi-

num bronze to work. Every alloy that you make in aluminum has to have a different type of gating according to how it's going to shrink or what type it is. Nickel alloys will shrink a little bit differently from silicon alloys, and zinc-bearing alloys will act still differently. And you also have to watch pouring in aluminum a little bit more than in brass too. You've got to realize one thing in aluminum; you don't have the heat that you have in brass—when you pour you have to break down awful fast.

Collier: Jake Dee says he pours his aluminum on the hot side and I think it's safer to be on the hot side, than on the cold side. We had a particular instance of a grid, we'll say 1 x 1-in. members, criss-cross in a lattice-work. It was 3 feet square with a heavy section all the way around. We were pouring those with what we thought was a good gating system, and we experienced trouble with holes that would turn up when they machined the face of the casting.

We traced it down, not to gas or bad molding practice, but to low pouring temperature. We figured that the metal was cold and actually trapped air. There were no inclusions in the holes and no real shiny surfaces like a blow or anything like that.

Dee: You have to gang-pour aluminum in a lot of places. You're not going to run it 3 or 4 feet from one side; you may have to use four pots.

Collier: In brasses—and especially anything like manganese bronze or aluminum bronze where you have a frothy condition and have to handle it quietly—a molder ordinarily will use a single gate where he can. Say you have a flat disc and you use two gates. The metal will form an oxide skin where those two portions of metal come together. There will be a definite line right where the metal stopped and set.

We generally try and get away from that by either using one gate or a pop-off on the other side to let some of that metal float through and clean itself out. But aluminum doesn't seem to work that way. It seems to be a better practice to use several gates to distribute your heat in the metal.

Winget: The oxide films stays in there because the metal happened to be getting close to the solidification point.

Collier: Do you think we can eliminate that by raising the temperature?

Winget: Yes, I do, and I think that probably what you were talking about with your cold aluminum awhile ago, having pinholes or porosity under the surface, is due to gas in the metal at the time it was in the mold. You didn't have them when your metal was hotter, because it stayed hot long enough to throw those gasses out.

Dee: We don't ever want to get the temperature hotter than is required for pouring. We will get it maybe a little above the pouring temperature, then flux it down and let it cool down to pouring temperature. I don't think you can say you pour on the high side or on the low side, I think there is a definite, proper pouring temperature for every casting. You should find that pouring temperature. For example, we pour a lot of gear castings, and a 50 F difference in pouring temperature will mean the difference between a good gear and a bad gear. I think a man has to find the proper pouring temperature for every job and then use a pyrometer to check the metal before taking it out on the floor.

Mitchell: I usually think of temperatures something like this. Say you know the approximate temperature it takes to run a certain casting, and you add maybe 50 F to be on the safe side and that is your standard. Then on the cold side, would be down approaching the temperature that you might mis-run it. The hot side is hotter than you would normally pour it. Of course, the higher the temperature of the metal, the more susceptible it is to absorbing gas.

Collier: I've been reading about this copper oxide treatment. If your ingot manufacturer delivers an ingot that has a low gas content and a slight residual phosphorus in it, by all rights you should be able to melt that slightly reducing. It would be more economical and you wouldn't have to deoxidize. I think the English are the ones that started this business of using copper oxide to add a controlled amount of oxygen to their heat, followed by deoxidizing with phos copper. Seems to me a couple of years ago we all did about that without any phosphorus.

Bird: Some foundries are ordering rough top ingots just because they want that oxide in the melt.

Dee: I think you'll find all the smelters now use quite a bit of scrap. They refine it but you'll find that the ingot will contain a certain amount of phosphorus and a certain amount of nickel.

Collier: Nickel, as I understand it, is about the only metal that the smelter can't remove.

Dee: That's right and I hope that they never remove it all. I think we should have some.

Collier: I would like to hear some comments on how much phos copper to use. For instance, when we were experiencing penetration we finally figured out that it was excess phos that was causing some of it. I don't know whether that had anything to do with lead sweat also. I know we get away from it when we introduce a controlled amount of oxygen into the melt and then deoxidize with phos copper.

Bird: A few years back I suddenly had a lot of trouble with burn-ins and penetration. We checked everything and came to the conclusion that it was excess phosphorus, because we found we didn't dare add any phosphorus at all. I finally found out that the smelters at that time were using phosphorus to clean their metal.

Dee: I think the amount of phosphorus is so small, you can add an excess. We add about 1½ oz of 15 per cent phos copper to a No. 70 crucible and I don't believe we've ever experienced any difficulty that we could attribute to the phosphorus. We have poured some 98 to 99 per cent copper castings. We always poured a test sprue to see if it was gassed and if it mushroomed up we'd throw in a little more phos copper.

This is the first time I've ever heard of excess phosphorus in ingot. We have had penetration troubles but blamed them onto something else, and worked them out.

Winget: I don't recall an excess of phosphorus in the ingots we've bought, but we do make some castings in which we use an excess of phosphorus as a hardener. We get a lot more penetration and we have a lot more fluidity.

Dee: Years ago we used lots of scrap such, as old hard bronze gears. We always use a coarse sand on heavy castings but we watch our temperature. We don't pour a heat at 2200 or 2300 F where 2050 will do.

Collier: Anticipating a burn-in condition on say 80-10-10 would you still use coarse sand?

Dee: Absolutely. Face the mold with coarse sand.

Collier: You can face your mold, and if it's going to burn in it's going to burn in. The only way I've found to stop it is to cut down the phosphorous, cut down the gas in the metal, and tighten up the mold face with silica flour.

Mitchell: I think burn-in is caused more by improper sand than anything else.

Dee: And improper ramming of the mold, such as uneven or soft ramming, that's got a lot to do with it. Pouring temperature is important, too. You wouldn't attempt to pour a 1000-lb, 80-10-10 bushing with a 6-in. wall thickness and maybe 20 in. in diameter with a 6 to 8-in. core at 2250 F. I would say 1950 would be a good pouring temperature.

Coley: An excess of phosphorus will no doubt cause penetration. We all know a high phosphorus copper should never be poured in green sand—that is a casting of any size. Of course, a skin dry will stop burn-in in green sand molds. I don't mean just run a torch over it, I mean dry it back far enough so the moisture won't seep back before pouring.

Collier: If I had my choice of a way to make a mold that I felt would be least likely to burn-in, I would use green sand throughout, with plumbago. I would expect a dry sand core in any mix that I could devise would burn-in more than the mold.

Mitchell: If I had the same grain size in both, I wouldn't expect one to penetrate more than the other.

Coley: I think the drying of the core would have a considerable influence. You can dry a core too fast, you can dry it too slow and not get the right burn-out of your oil, or whatever binder you're using. I use oil in all of my dry sand cores for brass and bronze and I think drying time and temperature have a lot to do with the penetration of the cores.

Collier: The only way I can be sure that I'm not going to have a burn-in problem is to close down the face of my core. We use silica flour and iron oxide and then wash the core green before it goes in the oven. When it comes out we coat it again with a zircon wash.

If you have a properly-baked core, you have considerable leeway. But I would think that an over-baked core would burn in more.

Coley: I find it just the other way. The excessive gas that the core throws off will heat the metal next to the core and cause penetration, where an over-baked core won't.

Collier: An underbaked core would blow before it would penetrate, I should think. Any core that isn't well baked would certainly give off enough gas to cause turbulence.

Bird: I've talked to metallurgists and experts and foundrymen in the biggest part of the country, and you fellows have all got this thing down pretty dog-goned well.

Collier: I'd like to say something about the technical boys. Now, I'm not a technical man in a foundry but I think it's wonderful that all these companies spend time and money on research and publish the results for us to read. Take all that stuff and transform it into good rule of thumb methods and you've got something.

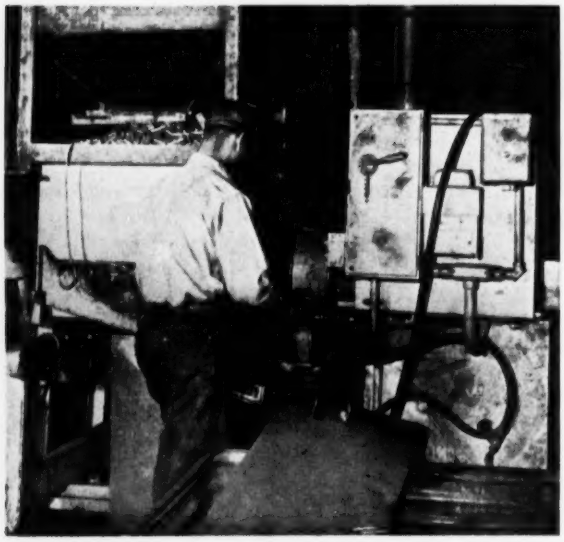
Coley: Sometimes it works the other way around. You solve a problem in the shop and then some technical man comes along, looks at it, and figures out why it works. They pick it up fast; they get it a lot faster than we get it from them.

Mitchell: There's a gap in some of the research that's done. The researcher is satisfied with what he's done but he hasn't completed the job till he brings it down to where the average foundryman can use it.

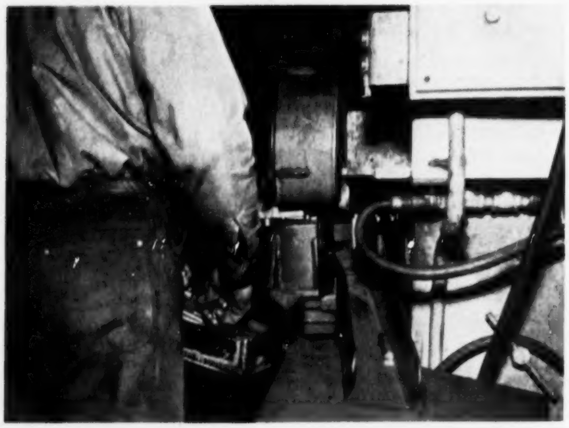
Winget: That would be a good subject to include in one of these round table discussions, the role of educational institutions . . . what they should do to train these boys that are coming up and going into the foundry.

New Snagging Machine Triples Guide Output

WILLIAM M. FITZSIMMONS / *Sup., Foundry Mill Room, International Harvester Co., Indianapolis*



Semi-automatic snagging machine, only one of its kind, designed to grind valve guides by Intl. Harvester Co.



Rotating fixture, seen under abrasive wheel guard, is hand-loaded, but snagging and ejection are automatic.

A new semi-automatic snagging machine, the only one of its kind, has tripled production of valve guides in the International Truck Engine Works. It was conceived, designed and constructed in the Indianapolis works foundry as another step in a continuing modernization and mechanization program begun several years ago.

▪ The principle of the new, high-output snagger is not new, and can be seen in similar equipment in some bearing plants. But so far as is known this is its first application to foundry grinding. Here's how it works:

Gray iron valve guide castings about 4¾ in. long and ⅞ in. in diameter are inserted by the operator into 19 holes around the edge of a circular, horizontally rotating fixture. The gate to be ground is at the top of the inserted piece.

The fixture, rotating clockwise, carries each piece into contact with the face of the 16 x 3 x 2 straight type, resinoid bonded, aluminum oxide grinding wheel. As each valve guide is ground clean of its gate it is carried on around to a point 270 degrees from the feed point and tripped out by an ejection arm. A hopper catches finished pieces at the end of a slide.

A floor plate below the rotating fixture automatically adjusts the height of the gate end of the valve guide. Any irregularity in length which would cause excessive grinding pressure or severe interference with the wheel will trip a height-limit switch and stop the rotating fixture so the operator can remove the piece. An exhaust system for removing ground particles and swarf also serves to catch the stream of grinding sparks.

Rough castings reach the operator by gravity feed from a hopper which holds approximately 2500 pounds of valve guide castings. The machine is powered by a 60 cycle electric motor which produces a grinding wheel speed of 1900 rpm, and drives the rotating fixture at slightly under 3 rpm, to grind 50 castings per minute. Grinding is done dry.

A dozen different rotating fixture plates were made up to accommodate various size valve guides ranging from 2¼ in. up to 4¾ in. in length, and from ⅝ in.

to $\frac{7}{8}$ in. in diameter. The changeover to another size fixture can be completed in less than 10 minutes.

Largely because no dressing is required, abrasive wheel life in the new snagger averages 10 months as against only 18 hours when the snagging was done by hand on floor stand grinders. Three thousand pieces per hour can be snagged with uniform and far better accuracy and alignment than was possible by hand-grinding where a maximum of 1,100 pieces could be produced, and then only by an experienced grinder operator.

The new semi-automatic is simple to operate and produces uniformly high quality grinding even in the hands of a totally inexperienced operator, who in 6 hours can turn out as many pieces as were formerly ground in 16 hours by hand. The machine is responsible for a reduction in the reject percentage from as much as 25 per cent down to the present maximum of about 2 per cent. Failure to grind the gate and surface perpendicular to the cylindrical side of the valve guide was responsible for most of the rejects when the work was hand ground, and rejects would increase sharply as the 1,100 piece per hour output level was approached.

Snagging here was and still is done on a piece-work basis. Formerly, an operator's production was calculated after weighing; now a six-digit serial electric counter keeps accurate tab on every ground piece, all of which has a beneficial effect on the operator's incentive to produce. The semi-automatic snagger incorporates every modern safety feature, and the operation and guarding of the abrasive wheel conforms fully to safety recommendations of the Grinding Wheel Institute and the A.F.S. Safety & Hygiene & Air Pollution Committee.

From general specifications outlined by the writer, with the able assistance of Albert Lee, general foreman, Foundry Mill Room, and the Plant Engineering Department, the new snagging machine was designed and built "from scratch." It has performed faultlessly without a single break-down since it was first put in operation a year ago.

Tailored to suit our needs exactly, the new equipment has greatly improved the efficiency of our valve guide snagging operation, and has given us these additional advantages:

1. Tripled snagging production, raising it from 1,100 maximum output by hand grinding to 3,000 pieces per hour. The work of two shifts is now done in one.

2. Removed the skill requirement from the operator's job classification.

3. Cut rejects from a high of 25 per cent under the old to 2 per cent maximum with the new machine.

4. Eliminated non-productive time required to dress the grinding wheel.

5. Increased abrasive wheel life from 18 hours to an average of 10 months, a substantial saving in wheel cost.

6. Greatly improved the accuracy and quality of grinding.

7. Provided an accurate count of pieces snagged.

Calendar of Future Meetings and Exhibits

June

29-July 3. . American Society for Testing Materials
Chalfonte-Haddon Hall, Atlantic City, N. J. Annual Meeting.

21-25. . Instrument Society of America
Sherman Hotel, Chicago. National Congress & Exhibit.

24-25. . Ohio Regional Foundry Conference
Netherlands Plaza, Cincinnati. Sponsored by A.F.S. Cincinnati, Northeastern Ohio, Central Ohio, Canton, and Toledo Chapters.

25. . Malleable Founders' Society
Annual meeting.

August

10-19. . Advanced Cast Metals Practice
University of Michigan, Ann Arbor, Mich.

September

17-18. . National Foundry Association
Plaza Hotel, New York. Annual meeting.

17-18. . Niagara Frontier Regional Conference
Statler Hotel, Buffalo.

19-26. . International Foundry Congress
Paris, France. Host: Association Technique de Fonderie de France.

21-22. . Steel Founders' Society
Homestead, Hot Springs, Va. Fall meeting.

October

8-9. . Michigan Regional Conference
Michigan State College, East Lansing, Mich. Sponsored by A.F.S. Central Michigan, Western Michigan, Detroit and Saginaw Valley Chapters and Michigan State and University of Michigan Student Chapters.

8-9. . Gray Iron Founders' Society
New Hotel Jefferson, St. Louis. Annual meeting.

9-15. . 5th International Congress of Mechanical Manufacture
Turin, Italy. Production methods and parts assembly.

15-17. . Foundry Equipment Manufacturers' Association
Greenbrier, White Sulphur Springs, W. Va. Annual meeting.

16-17. . Northwest Regional Conference
University of Washington and New Washington Hotel, Seattle. Sponsored by Washington, Oregon, and British Columbia Chapters, and University of Oregon Student Chapter.

29-30. . Metals Casting Conference
Purdue University, West Lafayette, Ind. Sponsored by Central Indiana and Michiana Chapters, Purdue University, and the Purdue Student Chapter.

February 1954

11-12. . Wisconsin Regional Foundry Conference
Schroeder Hotel, Milwaukee.

18-19. . Southeastern Regional Foundry Conference
Patten Hotel, Chattanooga, Tenn.

May

8-13. . A.F.S. Convention & Exhibit
Public Auditorium, Cleveland.

Convention Story Part II

▪ Concluding its news coverage of the 1953 A.F.S. Convention, *American Foundryman* reports this month on papers presented in the fields of gray iron, sand, steel, safety & hygiene & air pollution, refractories, time study & methods, plant & plant equipment, and costs. Brass & bronze, light metals, malleable, education, heat transfer, pattern and business and social meetings were reported in the May issue.

Gray Iron

The program of the Gray Iron Division included five technical sessions, one of which was a panel discussion of practical heat treatment, three shop course meetings, and a round table luncheon. At the first technical session, W. A. Schmidt and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, gave a progress report on A.F.S.-sponsored research in gray iron risering, and G. W. Nicholls, Modern Foundries, Ltd., Halifax, England, presented the official exchange paper from the Institute of British Foundrymen—"*Efficient Methods of Production of Machine Tool Castings.*" J. S. Vanick, International Nickel Co., New York, and F. J. Dost, Sterling Foundry Co., Wellington, Ohio, were co-chairmen.

Making the fourth progress report on gray iron risering research, Mr. Schmidt briefly reviewed previous work on the project, told what has been accomplished during the past year, and outlined plans for future work. Tests with a spherical casting show, he said, that hydrogen, oxygen, and water vapor appear to promote shrinkage in normally-sound, dry-sand castings. Water vapor produced gasiness in both dry and green sand castings, while nitrogen and carbon dioxide had no effect. Rate of riser feeding measurements show, he reported, that insulated risers for both green and dry sand castings stop feeding before the center of the casting reaches the eutectic. Substitution of a furnace to keep the riser molten will permit measurement of the influence of mold, metal composition, superheat, pouring temperature and rate, cooling rate, gases, and mass on shrinkage, he concluded.

(Left) Scene at speakers table of Sand Session. M. F. Drumm, Monsanto Chemical Co., (second from left) shakes hands with Chairman F. Carl, Fabricast Div., GMC. At left is Co-Chairman G. P. Phillips, International Harvester Co.; while G. D. Conger, Cambria Fdry. & Eng. Div., Stevens Mfg. Co., looks on. (Right) Calculations and records are being discussed by K. H. Priestley, Chairman, Gray Iron Shop Course Committee, Vassar Electroloy Prods., Inc., at Gray Iron Shop Course session. Others are meeting Chairman H. H. Wilder, Vanadium Corp. of Amer. (center); and W. W. Levi, Lynchburg Foundry Co.

Manufacture of sound castings begins with design, passes through the pattern department and control laboratory, and ends with the casting operation, Mr. Nicholls stated at the start of his comprehensive paper. He outlined production methods, showing how process instruction sheets and record cards were used, respectively, to insure attention to essential details and to follow the castings from order through machine shop. In discussing molding of planer beds and other large castings, he told how to include proper camber in the mold to minimize distortion in the casting.

Mr. Nicholls declared that continuous study of foundry processes results in lower cost castings of better quality, coupled with reduction of waste of valuable materials and loss of machine shop hours.

Phosphorus Removal

Dephosphorization in a basic cupola and a study of acid cupola slags were covered at a session which had H. A. Deane, Campbell, Wyatt & Cannon Foundry Co., Muskegon, Mich., and G. L. Richter, Farrel-Birmingham Co., Ansonia, Conn., as co-chairmen. Lt. J. E. Bolt, USNR, Bureau of Ships, Washington, D. C., described studies which showed, within the limits of the experiments, that phosphorus removal is faciliated by lower silicon in the metal and by lower metal temperature. Phosphorus can be removed without excessive carbon oxidation and limited desulphurization occurs with dephosphorization, he said.

Results of a study of 130 acid cupola slags from six different cupolas were reported by Sam F. Carter and Ralph Carlson, American Cast Iron Pipe Co., Birmingham, Ala. Output of the cupolas ranged from 1½ to 40 tons per hour. Messrs. Carter and Carlson concluded that fluidity was proportional to the total of all basic constituents or inversely proportional to the silica content. Mildly basic slags can be produced in acid-lined cupolas but are impractical for long heats, they reported. Increased coke as well as higher ash coke require more basic flux. Higher oxidation resulting in more SiO_2 requires still more basic flux. Iron oxide content of the slag is a good indication of the degree of over-all oxidation and correlates reasonably well with silicon loss.

Silicon Effective

At a third gray iron session, E. A. Loria, Carborundum Co., Niagara Falls, N. Y., related chill test depth to carbon equivalent, and E. P. Rowady, General Electric Co., Fort Wayne, Ind., and W. J. Murphy and J. F. Libsch, both of Lehigh University, told about the hardening characteristics of induction heated ductile iron. D. E. Krause, Gray Iron Research Institute, Columbus, Ohio, presided; F. T. McGuire, Deere & Co., Moline, Ill., was co-chairman.

Mr. Loria suggested that the effect of silicon in controlling chill depth is greater than has been recognized heretofore, after reviewing a study of automotive irons. Better correlation between chill depth and carbon equivalent was obtained when data used were selected on the basis of carbon-silicon ratio. Replotting the data on the basis of carbon plus 1.5 silicon instead of the customary carbon equivalent, he said, gives even closer correlation.

Results of the research in induction

Chairman J. A. Westover, Westover Engineers, looks over notes prior to a Time Study and Methods Session. E. C. Reid (left), Ford Motor Co. of Canada, Ltd.; Co-Chairman H. R. Williams, Williams Management Engineering; and L. L. Martin, Sterling Foundry Co., are interested onlookers.

G. W. Nicholls, Modern Foundries, Ltd., Halifax, Eng., delivers his exchange paper at Gray Iron Session. From left: W. A. Schmidt, Massachusetts Institute of Technology; J. S. Vanick, International Nickel Co.; F. J. Dost, Sterling Foundry Co.; and C. A. Johnson, Armour Research Foundation, Chicago.

Here is view of receiving line at President's Reception. From left: Mrs. F. J. Dost; Vice-President Elect Dost; Mrs. C. L. Carter; President-Elect Carter; Mrs. I. R. Wagner; and A.F.S. President Wagner, shown in Sherman House-on-the-Roof.

hardening of ductile iron indicate that surface hardening should give high surface hardness (R_c58) and good core properties. Response to induction hardening improves as the amount of pearlite in the prior structure increases, as the austenitizing temperature and time increase, and as the spheroidal graphite count increases. Completely ferritized ductile iron responded to hardening much more rapidly than a lot of ferritic malleable although instantaneous response to induction hardening appears possible only with pearlitic-ferritic structures with intermediate ductility (8-10 per cent reduction of area), the authors reported.

Magnesium Effects

Continuing discussions of magnesium-treated irons at another session, foundrymen heard *"Effect of Magnesium on Eutectic Modification and Graphitization of Certain Fe-C Alloys,"* by H. W. Weart and R. W. Heine, University of Wisconsin, and *"Prediction of Mechanical Properties from Chemical Composition for Fully-Annealed Ductile Cast Iron,"* by C. C. Reynolds, C. M. Adams, and H. F. Taylor, Massachusetts Institute of Technology. H. L. Ullrich, Sacks-Barlow Foundries, Newark, N. J., presided, and G. P. Phillips, International Harvester Co., Chicago, was co-chairman.

Mr. Weart described the production and examination of Fe-C-Mg alloys used to avoid complicating effects of the common elements in commercial cast irons. Magnesium acts on the solidifying ledeburite eutectic causing a coarser distribution of the austenite and carbide, he said, the agglomerating action increasing with increasing magnesium. Presence of elements found in commercial nodular iron is not essential to changing the freezing mechanism of the eutectic or in altering the shape of the graphite developed by heat treatment or in casting.

Carefully controlled experiments in which composition and section size were varied led to the development of formulas and graphs which make accurate prediction of mechanical properties of ductile iron possible, Mr. Reynolds asserted. He showed graphs which can be used to show deviation of graphite shape from the spherulitic form, which show how to adjust composition to achieve desired mechanical properties, and how to adjust ratio of hardness to tensile strength. The data indicate, he said, that carbon should be kept as low as possible for optimum mechanical properties.

The following five speakers and their subjects made up the heat treatment panel: J. E. LaBelle, Detroit Diesel Engine Div., General Motors Corp., Detroit, *"Fundamentals of Heat Treatment of Gray Cast Iron;"* J. H. Schaum, National Bureau of Standards, Washington, D. C., *"Stress Relieving Gray Iron;"* A. W. Demmler, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., *"Annealing Iron Castings for Machinability;"* A. A. Armstrong, Thompson Products, Inc., Cleveland, *"Through Hardening of Gray Iron;"* and M. R. Scott, Detroit, Flame Hardening Co., Detroit, *"Flame Hardening Cast Iron."* Presiding was G. A. Timmons, Climax Molybdenum Co., Detroit; R. A. Clark, Elector Metallurgical Div., Union Carbide & Carbon Corp., Detroit, was co-chairman.

Mr. LaBelle set the stage for subsequent discussion by reviewing the elementary metallurgy of gray iron with special reference to graphite and iron carbide and their behavior during various heat treatments. He told in practical terms what happens to a dead soft iron, an iron with normal carbides, and an iron with normal and massive carbides on heating to 1100 F, 1400 F, 1550 F, and 1700 F, as well as bringing out the effects of slow and rapid cooling from various temperatures.

In his paper, Mr. Schaum explained the undesirable effects of internal stresses in gray iron castings, the ways in which they are generated, and the techniques for relieving them by heat treatment. When stresses set up during cooling exceed the elastic limit of the metal, the casting will deform permanently at the point of highest stress —often at a notch or sharp corner, he said. Above about 750 F, cast iron deforms plastically with almost no elasticity. He told how tensile and compression stresses develop in a casting at it cools. These can be relieved, he said, by heating slowly to 1100-1200 F, holding the castings one to two hours per inch of thickness, and uniformly furnace-cooling to at least 300 F.

Compromise

Mr. Demmler pointed out the need for compromise between desirable mechanical properties and machinability is some instances. For machinability on a production basis, he said, hardness will run 150 to 200 Brinell and the microstructure will be massive ferrite with no carbides present. Annealing temperature will be 1550-1600 F with time dependent on section size.

Explaining that oil or water quenching, though satisfactory for simple, uniformly proportioned castings, often leads to distortion and cracking in complex shapes, Mr. Armstrong described isothermal treatments for the latter. He cited examples of a cylinder liner hardened isothermally to get minimum distortion, and the slide areas of a machine tool fixture hardened to the same level by isothermal quenching even though section sizes differed markedly.

Mr. Scott recommended use of an oxy-acetylene flame for flame hardening because it can be adjusted to give minimum decarburization of the surface. Normal techniques for flame heat-

ing can be used on gray irons containing 0.25 to 0.85 per cent combined carbon, he asserted. The usual flame-hardened case (0.03 to 0.12 in.) may break under the Brinell ball, and Rockwell C readings often vary, therefore hardness readings made by scleroscope are commonly used even though converted to other scales, he said. He described and illustrated the flame hardening of rolls, machine ways, and dies.

The popular Gray Iron Shop Course featured three evening meetings this year. At the first, D. E. Krause, Gray Iron Research Institute, led a discussion of *"Melting Conditions in the Cupola;"* W. Holden, Eaton Mfg. Co., Vassar, Mich., presided, and E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y., was co-chairman. K. H. Priestley, Vassar Electroloy Products, Inc., Vassar, Mich., spoke on *"Foundry Calculations and Essential Records,"* at the second meeting. Co-chairmen were H. H. Wilder, Vanadium Corp. of America, Detroit, and W. W. Levi, Lynchburg Foundry Co., Lynchburg, Va. *"Practical Aspects of Carbon Control in the Cupola"* was A. J. Dublo's (Sterling Foundry Co., Wellington, Ohio) subject at the third shop course session. W. W. Levi and E. J. Burke were co-chairmen.

Chill Test

Mr. Priestley traced the calculation of a furnace mixture and told how the chill test is related to microstructure and mechanical properties of the iron produced. He stressed the importance of keeping a daily record of cupola burn-out and all operating conditions such as bed height, condition of bed, time the first iron appears at the tuyeres, and temperature of the first tap and subsequent taps. These data should be correlated with frequent chemical analyses, he said. Pointing out that the record should be used for improving operations, he turned the meeting over to Mr. Levi who showed how such records could be used in predicting carbon content of cupola metal at the spout.

Carbon control is important, Mr. Dublo said at his session, to meet mechanical requirements, to prevent castings defects attributable to composition variations, to obtain good machinability and wear resistance, to promote soundness and pressure tightness, and to permit castings of complex shapes. Composition must be calculated on the basis of materials being charged, he said, in listing the following factors influencing final total carbon: carbon charged, bed height and preparation, amount of coke in splits, size of coke, air to coke ratio, size, physical characteristics, and rustiness of metallics in charge, spout temperature, tapping procedure, and amount of silicon in charge.

Contrary to the experience of many, Mr. Dublo said, his company's acid practice shows that larger coke gives higher final carbons than smaller coke under the same melting conditions. For maximum carbon absorption, melt hot, he asserted, but avoid excess blast which will give hot iron with inadequate carbon and fluidity. Tap regularly for uniform carbon pick-up he advised, and tap at shorter intervals to obtain lower carbons.

Discussion at the Gray Iron Round Table Luncheon on *"Casting Defects"* was led by W. A. Hambley, Chas. A. Krause Milling Co., Birmingham, Mich. W. W. Levi presided. Pointing out the economic waste involved in defective castings, Mr. Hambley decried the line of thought that a few cents here and there for reworking or extra finishing doesn't mean anything. The assumption that because you run a foundry you must have scrap is erroneous and without foundation, he declared. Continuation of losses may result because top management does not have adequate information concerning them, because no action is taken though information is adequate, or because management refuses to change some condition that contributes largely to scrap.

Mr. Hambley also pointed out that scrap can result from failure to know limitations of production facilities, from failure to evaluate ability and limitations of personnel, and from failure in human relations in the shop. He classified defects as chronic and epidemic and showed how a 30-ton a day shop can run a scrap loss as high as $600 due to inexcusable, chronic losses.

Sand

In addition to the Sand Shop Course, four sessions were held by the Sand Division, with a total of 11 papers presented. The first session included a paper by C. A. Robeck, Gibson & Kirk Co., Baltimore, Md., and C. A. Sanders, American Colloid Co., Chicago, titled: *"A General Look at Non-ferrous Molding Sands."* D. C. Williams and D. F. Baker, Ohio State University, Columbus, covered *"Factors Involved in Making a Sand Mixture,"* while W. G. Parker, Elmira Foundry Co., Elmira, N. Y., took as his subject: *"Deformation of Green Molding Sand."*

Robeck and Sanders did not advocate the use of any given sand or system, but reviewed the most advantageous use of synthetic and naturally-bonded sands. The former, they said, is best for mechanized operations, while natural sands are of greater use where the least amount of care can be expended. The authors traced the development of synthetic sand in non-

The ladies enjoyed themselves at the A.F.S. Ladies' Tea. From left: Mrs. Robert Hendry, Mrs. R. P. Schauss, Mrs. C. V. Nass, and Mrs. B. C. Yearley, shown at Sherman event, which was held on Monday, May 4.

The President's Reception was the occasion for this smiling group. From left: Mrs. I. R. Wagner; I. R. Wagner, President, A.F.S.; J. W. Wolfe, Executive-Secretary, Non-Ferrous Founders' Society; Mrs. Wolfe; and E. J. Walsh, Executive-Director, Foundry Educational Foundation, Cleveland.

ferrous foundries, pointing to their economy, and to the non-uniformity of natural sands, which also suffer from varying chemical composition and low durability in fine grained types. The advantages of natural sands were also outlined. The more popular non-ferrous sands were described and the paper concluded with a series of formulas for their use.

In their paper on sand mixtures, Messrs. Baker and Williams discussed experiments in use of energy input to the mixer as a scale for evaluating the mixing action and also the properties of the mixture. Energy required to drive an electric motor that operated a ribbon-type mixer was measured with a recording wattmeter. Amount of power consumed by the motor with various sand mixes was used as an index.

Addition of water was found to cause a definite increase in the energy consumed in the mixer, while kerosene additions to sand were found to have practically no effect. One per cent kerosene in a sand-water mixture was determined as an optimum ratio wherein energy increases due to the presence of water were effectively inhibited. The authors concluded that water in a mixture has more effect on expended energy in proportion to weight than either clay or sand. They summarized by stating that this technique could conceivably be used as a tool for studying the forces of adhesion in green molding sand, or even for quality control of foundry sand mixtures.

Deformation

In his paper, Mr. Parker discussed the factors involved in establishing the Sand Toughness Number (STN) for a sand system. Gating, casting, section size, kind of metal, temperature, and other conditions all have a vital effect. He described the use of various accessories to measure green and hot deformation of molding sands, although his paper specifically covered current work on green sands.

Sand Toughness

Early work in this area resulted in a factor called resilience, now referred to as sand toughness. Experiments, said Mr. Parker, indicate that sand mixtures of the same STN usually give parallel results in performance, although grain shape, size, and screen distribution affect strength values. He concluded that deformation values have a definite place in the control picture, giving foundrymen a two-fold test: the effect other physical properties have on deformation, and the part deformation plays in calculating sand toughness number.

B. H. Booth, Carpenter Bros., Inc., Milwaukee, presided at this session. H. W. Dietert, Harry W. Dietert Co., Detroit, was chairman.

At the second session of the series Fred Carl, Fabricast Div., General Motors Corp., Bedford, Ind., was chairman, with G. P. Phillips, International Harvester Co., Chicago, as co-chairman. Two papers were delivered: *"Resins and Sands for Shell Molding,"* by M. F. Drumm, Monsanto Chemical Co., Springfield, Mass.; and *"Progress Report, Shell Molding Materials Testing,"* by G. A. Conger, Cambria Foundry & Eng. Division, Stevens Mfg. Co., Ebensburg, Pa.

Mr. Dumm stressed the importance of proper choice of a sand and resin binder for shell molding. Particle size distribution and grain shape are significant, he said, but the condition of the sand surface is extremely vital. Flexural and tensile tests seem to offer excellent control methods for the shell molding foundry. The tests were described and their function in selecting the resin was outlined. They may also be used to evaluate the sands used in shell molding, the author said. The flexural test presents several advantages over tensile strength indication, largely because the values are greater, allowing easier recognition of differences in mixtures.

In his report, Mr. Conger defined the purpose and function of the Shell Molding Materials Testing Committee as "the determination and recommendation of methods and procedures for shell mold properties." A series of property evaluation programs were enumerated to be investigated by the committee as a whole, including: reference sand; cured strength, hot and cold; mixing procedure; cured permeability; cured deflection, hot and cold; sample preparation; and hardness.

Properties of a reference sand that had been selected, were detailed. Known as "Tentative 8-N Reference Sand," it is to be produced by Pennsylvania Glass Sand Co., Pittsburgh, Pa.

Mr. Conger reported that a tensile evaluation program was in full operation and that the tentative standards would be available before summer 1953.

Sand Ramming

J. B. Caine, Cincinnati foundry consultant, presided over the third sand session. Co-chairman was W. S. Pellini, Naval Research Laboratory, Washington, D. C. A paper co-authored by H. W. Dietert and A. L. Graham, Harry W. Dietert Co., was presented.

Titled *"Ramming of Molding Sands,"* the paper covered the effect of squeeze pressures on the physical properties of four production molding sands. Showing that, by definition, rammability and flowability are not identical, the authors described the results of various ramming pressures. Knowledge of these effects for a wide range of ramming pressures allows calculation of alterations in sands where high pressure molding is employed.

Green hardness, the authors stated, increases steadily as squeeze pressure is increased, in turn causing a rise in density. Among other conclusions, it was maintained that the rammability of a sand may be measured by determining the squeeze pressure required to obtain a predetermined green hardness value.

Effects of squeeze pressure on hot strength, retained strength, air-set and dry properties, and green properties, were indicated for the series of tests conducted in the experiments.

Session Chairman Caine delivered

The Annual Non-Ferrous Dinner was held at the Bismarck Hotel, May 4, and attracted a large crowd of foundrymen.

Among other groups that met during the A.F.S. Convention was the Board of Directors of the Foundry Equipment Manufacturers' Assn., which convened in the Holiday Room of the Sherman on May 5. The Association also held its annual reception in the Morrison's Cotillion Room on May 6, just prior to the Annual Banquet of A.F.S.

Officers and trustees of the Foundry Educational Foundation met during the A.F.S. Convention at the Sherman. Luncheon and meeting were held in the Jade Room on Thursday, May 7.

L. N. Shannon (left), Stockham Valves & Fittings, Inc. and President, International Committee of Foundry Technical Associations, listens attentively to Mrs. H. S. Simpson, far right, with H. S. Simpson, National Eng. Co.; and Mrs. Shannon.

Pictured at Plant and Plant Equipment Session are (l. to r.): L. B. Koenig, J. I. Case Co.; H. W. Johnson, Wells Mfg. Co.; James Thomson, Continental Foundry & Mach. Co.; and H. C. Weimer, Beardsley & Piper Co.

the A.F.S. Flowability Committee report. He described the work of the committee as restricted to developing a test simulating the conditions prevailing in the mold or core surface when pressure is applied during ramming, squeezing, jolting, or blowing. Work has been done on visual flowability standards, which were included with the paper. Basic flowability test procedures were outlined, with detailed recommendations included.

H. H. Fairfield and James McConachie, William Kennedy & Sons, Ltd., Owen Sound, Ont., presented *"Casting Surface Finish and Flowability of Sand."* The authors reported on experiments made to measure flowability of molding and core sands, and to relate these test values to surface finish. They contended that surface finish is more dependent on flowability than on the grain size of the sand. A quantitative test for sand flowability was advocated in order to assist sand control technicians in developing mixtures that could be rammed to a smooth finish with the least amount of work.

A series of comparisons were made between the Kennedy flowability test and the A.F.S. Flowability Committee test. The latter was shown to correlate closely with the Kennedy test on four different sand mixtures.

Final session in the sand series had one paper and two reports: *"Induced Flow Process of Baking Oil-Bonded Cores,"* by C. T. Marek, Purdue University, Lafayette, Ind., and R. J. Wimmert, Air Reduction Corp., Union, N. J.; *"Veining Tendencies of Cores—Committee 8-J Report,"* by H. H. Fairfield; and *"Sand Research—Progress Report,"* by H. Robinson, Cornell University, Ithaca, N. Y. Chairman was E. C. Zirzow, Werner G. Smith, Inc., Cleveland and co-chairman, H. W. Meyer, General Steel Castings Corp., Granite City, Ill.

Drying Time Reduction

The paper by Messrs. Marek and Wimmert reported on experiments with the induced flow process for forcing heated air through cores. The authors found this method to be superior to conventional core drying systems in several ways. Time was materially reduced, higher tensile strengths were obtained, thorough core drying resulted, no surface burning was apparent, and a linear relationship was found between tensile strength and the pressure difference across the core. In addition, it was concluded that the rate of air flowing through the core varies in a straight line ratio with pressure. Various drying times and air volumes were used, and the results were indicated.

The authors delineated the principles of the induced flow process, using drawings and illustrations of the equipment. Procedures and results were presented in the paper.

The progress report on veining tendencies covered their occurrence in gray iron castings and supplemented an initial report on this project at the 1952 Convention. Results of tests were presented with a summation on various cores used in experiments. The committee found that impure sands decrease veining while iron oxide prevents it. Excess binder, hard ramming, overbaking, high pour temperature, and excessive moisture also may promote veining, the report maintained.

The report on sand research was prepared by R. G. Thorpe, H. Robinson, P. J. Wisniewski, and P. E. Kyle,

all of Cornell University, Ithaca, N. Y. It covered sand research completed at the university in 1952-53 under the sponsorship of the A.F.S. Sand Division. In two parts, the report covered stress-strain and expansion studies of 11 synthetic steel sand mixtures at elevated temperatures in part I; and summated test casting results on scabbing tendencies of sand mixtures in part II.

The authors concluded that the maximum temperature at which expansion exceeds allowable deformation varies in different steel sand mixtures. They further confirmed a previous report that the scabbing tendency of the sand increases in direct line with temperature.

Shop Course

Subjects of discussion at the three Sand Shop Course meetings were *"Pinholes in Castings," "Molding Methods,"* and *"Hot Properties of Molding Sands and Their Relation to Casting Defects."* Five speakers appeared on the molding processes program under the co-chairmanship of Hiram Brown, Solar Aircraft Co., Des Moines, Iowa, and R. H. Olmsted, Whitehead Bros. Co., Conneaut, Ohio. In introducing the speakers, Mr. Brown called attention to the widespread use of the term *precision* in describing casting processes and suggested that when referring to a *precision casting* the name of the casting process should also be used.

C. E. Maddick, Massey-Harris Co., Brantford, Ont., discussed green sand molding, stating that it is characterized by economy, versatility, and rapid production. To make the most of green sand, he advised use of such basic tests as moisture, permeability, green compression, mold hardness, grain distribution, loss on ignition, hot strength, and dry strength. The speaker showed how sand records are kept in his plant, and how molding operations are prescribed on a routing card which gives all details including number of jolts, pouring time, and such added comments as "finish by pouring through riser," "shake-out time, 1½ hr;" and "bottom boards must be flat and well bedded."

Permanent Molding

W. B. Scott, National Bearing Div., American Brake Shoe Co., Meadville, Pa., commented on permanent mold and die casting, and referred briefly to vacuum die casting and slush casting. While about 70 per cent of the aluminum castings are produced in permanent molds and dies, the figure is only six to nine per cent for copper-base alloys, and about one per cent for iron (permanent mold). No steel is permanent molded commercially, he said, and most magnesium castings are presently made in sand.

The Past Presidents' Breakfast brought out 11 former A.F.S. heads. Shown here, standing, from left: Herbert S. Simpson, Natl. Eng. Co., (1941-42); Wyndham R. Bean, retired, (1920-22); Fred J. Walls, International Nickel Co., Inc. (1945-46); W. B. Wallis, Pittsburgh Lectromelt Furnace Corp. (1948-49); Marshall Post, Birdsboro Steel Fdry. & Mach. Co. (1939); R. E. Kennedy, Secretary-Emeritus, A.F.S.; and Dr. G. H. Clamer, Ajax Metal Div., H. Kramer & Co. (1923-24). Seated, from left: H. Bornstein, retired, (1937-38); Ralph J. Teetor, Cadillac Malleable Iron Co. (1944-45); W. L. Seelbach, Superior Foundry, Inc. (1950-51); C. E. Hoyt, former Executive Vice-President, A.F.S.; Benjamin D. Fuller, retired, (1917-18); and L. N. Shannon, Stockham Valves & Fittings, Inc. (1940-41).

Tolerances of die castings are generally in the range of plus or minus 0.003 to 0.005 in. per in. while permanent mold castings run plus or minus 0.005 to 0.010 in. per in., Mr. Scott stated. Die casting of copper-base alloys has been held back by lack of suitable material for dies, he declared, in pointing out that in permanent molding of brasses and bronzes, mold life may vary from a few hundred pieces to several thousand, representing the biggest single cost of production.

Dry sand molding was reviewed by G. W. Anselman, Beloit Foundry Co., South Beloit, Ill. He highlighted his remarks with examples of large castings made in dry sand to prevent sand washing and mold wall movement. He gave as a typical pouring time, 75 seconds for a 14-ton die shoe requiring 18 tons of metal. The mold cavity was bowed ¾ in. so that on cooling the casting would be straight. Machining allowance on the casting (18 ft long, 5 ft wide, 1½ to 6 in. thick) was ½ in. all over. In contrast, Mr. Anselman showed small squeezer castings made in the same base sand as the large castings. Difference in his green and dry sand, he said, was that he used sea coal in the green sand and pitch compound in the dry sand.

Two Areas

Don't sell your sand casting foundry, but don't ignore this newcomer to the foundry industry, Mr. Stazinski warned, in talking about the place of shell molding in the field of castings production. He recommended applying shell molding in two broad areas—on parts that are not now cast and parts that will benefit from higher precision, smoother finish, lighter weight, and less machining. He listed as unfavorable cost factors for shell molding: high resin cost, clamping and backing of shells, and patterns. On the favorable side, he asserted, are: shell making operation costs less than comparable sand mold, floor space requirements are low, scrap losses are low, and casting weight is less due to reduced metal sections and elimination of some machine finish allowances.

All-Core Mold

Mr. Antonic pointed out that casting design often dictates the use of an all-core sand mold and cited air-cooled cylinders in which metal sections must be held to within 1/64 in. as an example. In addition to good dimensional control, he included smoother finish and greater mold wall stability—the latter making possible smaller risers—as advantages. Core molds permit greater flexibility in gating and risering than any other form of molding, he stated, because after assembly the mold can be turned into any desired position for pouring. Another advantage mentioned was the economical handling of short runs which do not warrant investment in special flask equipment.

Asked about high pressure molding, Mr. Antonic said that use of squeeze pressures of some 1000 psi showed considerable promise as a means of producing precision molds with uniform hardness and smooth surface finish. Absence

The A.F.S. Ladies' Tea was graced by Mrs. I. R. Wagner (seated), and Mrs. W. W. Maloney.

W. A. Hambley (left), Chas. A. Krause Milling Co.; and Chairman W. W. Levi, Lynchburg Foundry Co., discuss Hambley's speech on casting defects at Gray Iron Round Table Luncheon.

Shown at Alumni Dinner (l. to r.): A. G. Storie, Fittings Ltd.; B. D. Fuller, retired; C. E. Hoyt, former Executive Vice-President, A.F.S.; Dick Evans, Chicago Steel Foundry Co.; and Dr. G. H. Clamer, Ajax Metal Division, H. Kramer & Co.

of moisture makes a low permeability mold feasible, he pointed out.

The "D" process, brought up in discussion from the floor was explained by another member of the audience, Harry W. Dietert, Harry W. Dietert Co., Detroit. He described it as a new process for producing "contour" cores or thick "shells." Conventional blowing and baking equipment are used but the vegetable binder bakes in only about 30 minutes. Cores go through a short curing period, then can be poured after assembly without backing material.

At the sand shop session on hot properties of molding sands, H. W. Meyer, General Steel Castings Corp., Granite City, Ill., spoke on steel, and B. C. Yearley, National Malleable & Steel Castings Co., Cicero, Ill., spoke on malleable. Fred E. Kurtz, Electric Steel Castings Co., Indianapolis, Ind., was chairman.

Hot Strength Test

Most common elevated temperature tests used are for hot compressive strength, expansion-contraction, and thermal shock, Mr. Meyer stated. The hot strength test is used primarily to determine the characteristic influence of various sand mix components. Minimum contraction is desired in a sand mix because it leads to minimum scabbing, he said, adding that while minimum expansion is desirable it is not as important as contraction. Sand mixes which have relatively little expansion and with maximum expansion occurring with a very short exposure at elevated temperature, have little tendency to cause hot tearing.

The thermal shock test, easiest and quickest to perform, is a positive guide to burned-on sand, metal penetration, veining, scabbing, erosion, and sand inclusions, Mr. Meyer said. Thermal shock resistance is better if the base sand is subangular to angular, he stated, recommending coarser sand or addition of cellulose material to improve thermal stability. Poor thermal stability may result from insufficient mixing and mulling, resulting in nonuniform distribution of sand additives.

Mr. Yearley reminded his listeners of the need for compromise in choosing ingredients for a sand mixture, pointing out the conflicts arising in a sand that won't cut or wash but has excessive hot strength leading to hot tears and shakeout difficulties. Or a sand that won't deform thereby leading to scabs. He cited instances of cores with no hot strength above 1500 F that produced hot tears and suggested that hot tearing is a matter of time required to collapse rather than hot strength.

Speakers at the *"Pinholes in Castings"* session were W. B. George, R. Lavin & Sons, Chicago; L. E. Emery, Marion Malleable Co., Marion, Ind.; and G. R. Gardner, Aluminum Company of America, Cleveland. F. S. Brewster, Harry W. Dietert Co., Detroit, presided; co-chairman was K. L. Landgrebe, Wheland Co., Chattanooga, Tenn.

Messrs. George and Emery discussed
continued on page 110

★ Convention Paper

The Influence of Molding Materials on the Incidence of Hot Tearing

J. M. Middleton / *Research Officer, British Steel Castings Research Assn.*

A technique that has been developed for the quantitative assessment of the hindrance to the contraction of a steel casting that is offered by various molding media is described. The effect of variations in bond content, in ramming density, and in grain size of the molding media, are indicated, and data relative to the range of temperature and to the time after pouring within and at which hot tearing occurs are presented. The trends indicated by the results obtained are applicable to castings of similar size to that employed in the test and to steels of carbon and sulphur contents different from those of the test casting. The work is being continued to determine corresponding information relative to larger castings whose greater heat capacity will affect the thermal conditions in the mold.

▪ It is a well-known fact that steels have practically no strength nor ductility at temperatures near to their solidus.

Should the resistance to thermal contraction offered by a mold be high at these temperatures, the stresses induced in the casting may exceed the strength of the steel and rupture or hot tearing will result. Different molding media, by reason of their chemical and physical compositions, have different strength properties at elevated temperatures, and may, therefore, be expected to offer varying degrees of hindrance to contraction while the steel is in the hot-tearing range.

Little information has been published upon the effect that different molding media have upon the incidence of hot tearing in steel castings. Some preliminary work in which the test castings were in the form of cylinders of various diameters and wall thicknesses has been reported,[1] the casting contraction being resisted by the cylindrical core and the tearing being located below the casting ingates. However, the results reported were inconsistent, tearing being associated with molding materials known to have low hot strength and not with materials known to have a high hot strength.

A large amount of work has been done in determining the strength properties of molding media at elevated temperatures, but few attempts have been made to apply this information to the solution of the problem of hot tearing. This is probably due to lack of information regarding the mode of tearing and to the thermal conditions existing in molds and castings after pouring.

The objects of the investigation were:

1) To evolve a test capable of measuring the amounts of hindrance to contraction offered by various molding media under casting conditions and the incidence of tearing in the casting.
2) To determine the range of temperature and the time after pouring during which hot tearing occurs, and the thermal conditions prevailing in the mold and casting during that time/temperature range.
3) To study the effects of variations in ramming density, bond content, and grain size of the molding media, and in the casting temperature of the metal, upon the incidence of tearing in the casting.

Part I — Test Method

The test method which has been evolved embodies the following features:

Preprint 53-73. This paper was presented at a Steel Session at the 57th Annual Meeting, American Foundrymen's Society, Chicago, May 4-8, 1953.

Fig. 1A—Photograph of the apparatus.

1) The molding material to be tested is so included as to hinder the contraction of the casting.

2) The molding material is capable of being reproducibly rammed to any predetermined degree.

3) The design of the casting is such as to provide a hot spot where tearing may be initiated.

4) There are means by which the load induced in the casting by hindrance to contraction at any time after pouring can be measured.

The apparatus is shown in Figs. 1A and 1B. A 1 in. square section bar 21½ in. long is cast in a specially designed two-part molding box, and binds onto a notched steel bolt *A* which is previously placed in the mold cavity. The bolt is attached to a plunger which bears onto a flat calibrated spring, the spring being seated on two hardened steel rollers which act as fulcrums. The spring is so designed as to deflect 0.001 in. for each load increment of 10 lb, previous work having shown that restriction by a spring of this strength causes extensive tearing in a similar casting.

The bending moment of the spring is measured by a dial gauge that is graduated in 0.0005 in. The casting is fed by a 4x2½x1½-in. rectangular runner *B*, which is adequate to feed the 1 in. square section bar and to form a hot spot where tearing may be initiated. A rectangular-shaped block of the molding material to be tested is placed between the runner and a ⅝-in. thick steel plate that is bolted across the top part of the molding box, the plate extending to within ½-in. of the mold face.

The inclusion of this steel plate ensures that as the casting contracts, the movement of the runner is resisted solely by the test block and that variations in ramming density in the remainder of the mold can have no influence on the hindrance to contraction offered to the casting.

The solid contraction of the cast metal is, therefore, restricted both by the calibrated spring and by the test block; the casting, test block and spring form a closed stress system, in which the load induced in the casting by the restriction of movement of the runner by the test block is equal in magnitude to the load causing deflection of the spring.

If the action of the molten metal causes complete collapse of the test block no load is induced in the casting and no deflection of the spring can occur. If, however, the molding material has high strength at elevated temperatures, and therefore offers high resistance to movement of the runner, then the contracting casting will cause deflection of the spring.

The amount of deflection at any time after casting will depend upon the strength characteristics of the molding material and the rate of contraction of the casting. The rate of contraction of the casting will depend upon its casting temperature and can be kept constant from test to test.

If the resistance to contraction offered by the test block is high while the metal is weak, then tearing will occur at the hottest spot, i.e., at the junction of the runner and the bar.

Three base sands were used, Arnolds 26A, Arnolds 52A and Chelford medium, the gradings of which are given in Table I. All mixes were milled for at least 4 min in a 20-lb Fordath mixer. Western bentonite was used throughout the tests, except where noted differently.

In order to eliminate variations in ramming density, test blocks were made by pressing a known quantity of sand to a definite volume in a specially designed metal core box. The pressure needed for compaction was applied by means of a Denison compression testing machine, the load required for compaction being noted. The pressed blocks were 5½x4x 2½-in. thick. At least three blocks were made from each mix, one to be included in the test casting, and the others for the purpose of determining their room-temperature properties.

A large number of blocks of this size gave good

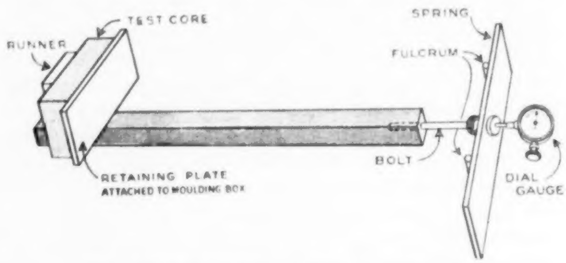


Fig. 1B—Isometric sketch of apparatus.

reproducibility of compressive strength and hardness test results, and therefore the strength of the blocks used to hinder contraction of the casting could be assessed. Drying of the test blocks where necessary was done in a laboratory oven, the clay-bonded sands being dried for 3 hr at 200 C (392 F) and the organic bonds for 1½ to 3 hr at 170 C (338 F) or 200 C (392 F) depending upon the nature of the bond.

Testing Procedure

The mold was rammed up with a thick facing of Arnolds 26A sand plus 3 pct bentonite and 2½-3 pct water, the test block being positioned in the mold immediately before pouring.

Melting was carried out in a 20-lb capacity high-frequency furnace, the melting conditions being held as constant as possible from one test to another. Deoxidation was effected by ferro-manganese and ferro-silicon and, finally, with aluminum at the rate of 2 lb per ton of steel.

Previous work[2] with a similar size of casting having shown that metal composition and casting temperature have a pronounced effect on the susceptibility of steel to tearing, the casting temperature in all tests (excepting those in which the effect of variation of casting temperature was investigated) was held at 1575 C (2867 F), and the metal composition was held within the following limits:

	Per Cent
Carbon	0.25-0.28
Silicon	0.38-0.45
Manganese	0.85-0.9
Sulphur	0.036
Phosphorus	0.032

All temperatures were measured with Pt/Pt-13 pct Rh immersion thermocouples in conjunction with a quick-reading potentiometer.

Spring deflection readings were taken immediately after completion of pouring, and subsequently at time intervals of 5 sec for a total period of 4 min.

All test bars were sectioned at the position of tearing, that is, through the junction of the bar and runner, and the sections were surface ground and etched for 7-10 min in a hot 1:1 HCl solution. The length of tear was measured in millimeters.

Part II — Determination of Temperature Conditions Under Which Hot Tearing Occurs

Temperatures were measured by means of Pt/Pt-13 pct Rh thermocouples at three positions in the casting and five positions in the test block. The temperatures recorded are shown in Fig. 2, in which the curves may be identified with the following thermocouple positions:

Casting

a) Immediately below the runner at the position of tearing.

b) Towards the end furthest from the runner, 3 in. from the end of the insert bolt.

c) As near as possible to the center line of the bar and beneath the runner.

Test Block

d) At the metal/sand interface between the test block and runner, the single length of silica quill and thermocouple being so arranged along the test block as to protrude slightly into the mold cavity.

e) f) g) h) The thermocouples were placed so that their bare junctions were at the center line of the block and at various distances from the interface. The exact distances were determined by carefully breaking up the core after casting.

At positions a) and b) bare thermocouples were used and were so arranged as to protrude slightly into the mold cavity. By this means skin temperatures

TABLE 1

U.S. Standard Sieve Series	B.S.I. Sieve No.	Coarse (52 A)	Medium (Chelford)	Fine (26 A)
	8	0.0	0.0	0.0
6		0.0	0.0	0.0
	10	0.0	0.0	0.0
12		0.0	0.0	0.0
	16	1.0	0.1	0.6
20		2.5	0.0	1.5
	22	4.8	0.2	0.5
30		10.0	1.0	0.7
	30	27.7	1.5	1.2
40		52.5	4.5	1.8
	44	52.5	14.1	3.6
50		30.0	22.5	4.0
	60	11.5	30.4	6.7
70		3.5	43.0	11.5
	72	1.0	27.7	6.9
100		0.8	20.6	31.5
	100	0.8	20.6	31.5
140		0.4	7.2	39.8
	150	0.4	7.2	39.8
Pass 140		0.3	1.2	9.2
	Pass 150	0.3	1.2	9.2

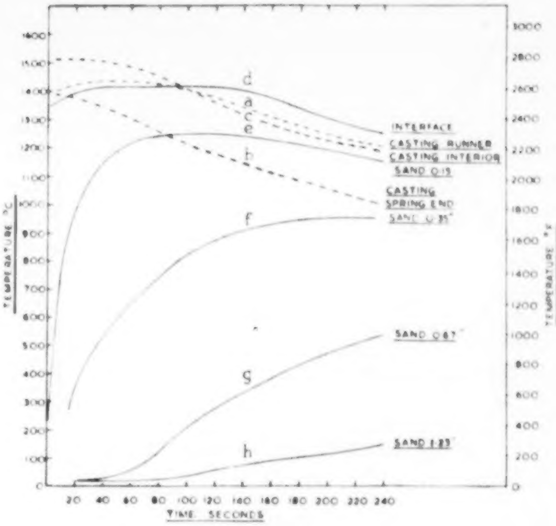


Figure 2

of the casting at these positions were recorded. The thermocouple at c) which measured the temperature existing in the interior of the casting at the position of tearing consisted of a single length of silica quill bent in the form of a U, the two thermocouple wires being butt welded and forming a junction at the center of the U.

This construction ensured that at least 1½ in. of the thermocouple was in contact with hot metal, thereby reducing any errors which might otherwise have arisen as a result of conduction. The actual position at which temperatures were measured was determined by carefully sectioning the casting when it was found that the thermocouple had moved slightly and was along the vertical center line of the bar about 0.35 in. from its upper surface.

It will be seen from curves a) and b) of Fig. 2 that a considerable temperature gradient existed along the skin of the casting from the runner to the opposite end of the bar; temperature differences of 65 C (149 F) and 180 C (356 F) being recorded 30 sec and 75 sec after completion of pouring, and the runner forming an appreciable hot spot.

The maximum interface temperature attained [1431 C (2608 F)] at the position of tearing was below that of the solidus of the steel [approx. 1470 C (2678 F)], but near the center of the section of the bar at this position, curve c), a time of 70 sec elapsed before the temperature fell below the solidus of the steel. Curve c) shows an arrest at 1510 C (2750 F), i.e., the liquidus of the steel, which was complete 30 sec after pouring. The sand/metal interface, curve d), quickly reached a temperature of 1420 C (2588 F) and remained above 1400 C (2552 F) for a period of 140 sec.

The marked temperature gradients that existed in the test block are shown more clearly in Fig. 3, but it will be noted that 55-75 sec after pouring a 0.1-in. depth of sand was heated beyond 1300 C (2372 F) and a depth of 0.05 in. was heated above 1350 C (2462 F). The strength of this depth of heated sand must largely control the amount of resistance that the

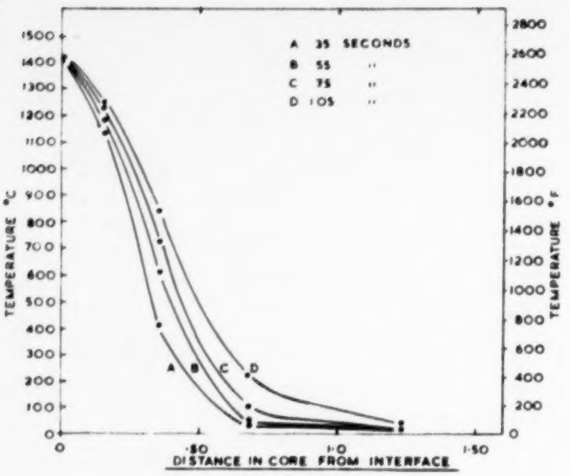


Figure 3

test block can offer to the movement of the runner, and therefore the amount of stress induced in the casting during the first few moments after pouring when tearing is most likely to occur.

Temperature of Tearing

Previous work[2] on a casting having similar design has shown that tearing occurs at temperatures between 1400 and 1420 C (2552 and 2588 F) during the first 55 to 80 sec after pouring, depending upon a) the degree of hindrance to contraction offered by the mold or core, b) the casting temperature, and c) the composition of the steel. Work by Bishop and co-workers[3] puts forward evidence to show that tearing is initated at temperatures near to the solidus, when a small amount of liquid remains unfrozen, and suggests that the tears are propagated through these weak fluid films.

In order to ascertain when tearing takes place in the casting investigated, a cast was made in which the contraction of the casting was resisted solely by the spring, that is, the runner end of the casting was held rigid. The results are shown in Fig. 4.

The casting tore completely (Fig. 5) with a load of 55 lb 55 sec after pouring. At the position of tearing the temperature at the skin of the casting was 1431 C (2608 F), and in the interior of the casting it was 1488 C (2710 F). This latter temperature is approximately 20 C (68 F) above the solidus of the steel, which means that at the time of tearing at this position there would be approximately 16 pct of liquid steel in contact with 84 pct solid.

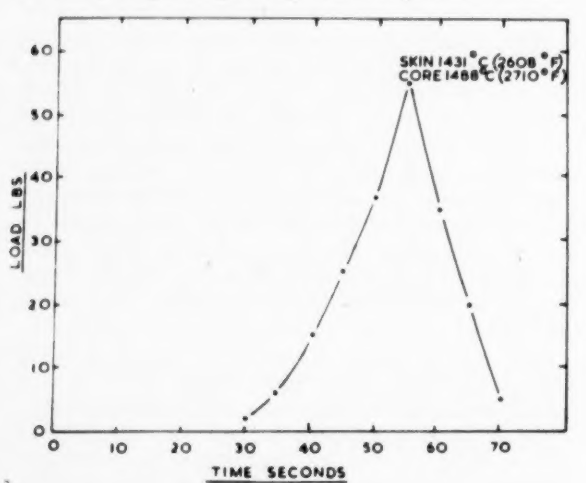


Figure 4

This supports the hypothesis of Bishop and coworkers[3] that tearing can be initiated while liquid metal is present. However, tearing does not occur at one particular temperature, but can be initiated over a temperature range, from the point at which the freezing metal forms a coherent mass down to the temperature at which the last liquid freezes, or when the metal quickly attains strength or ductility.

Cooling curves taken on the casting being studied have shown a) that some liquid metal is present in the casting for at least 70 sec after pouring, and b) that the first signs of solid contraction in a freely contracting bar occur 30 to 35 sec after pouring. The period from approximately 30 to 70 sec after pouring is, therefore, the hot-tearing range for this particular casting under the experimental conditions of steel composition and pouring temperature that were employed.

Fig. 5 — Complete tear in casting in which the movement of the runner was restricted.

In the subsequent experiments, reported in Part III, the loads that were induced in the casting by hindrance to contraction at 55, 75 and 105 sec after pouring have been used for comparison, it being considered that these readings represent the time range in which hot tearing can occur.

The correlation obtained between the load on the casting 75 sec after pouring and the extent of tearing in the casting is shown in Fig. 6.

Part III — Effect of Variables Upon the Incidence of Hot Tearing

A number of preliminary tests were made to determine the degree of reproducibility of results from one test to another, and Fig. 7 shows repeat-test curves of the loads induced in the casting by hindrance to contraction at different times after pouring. The additions made to the sand mixes employed in these preliminary tests were: a) 5 pct bentonite and 20 pct silica flour, b) 1.5 pct linseed oil, and c) 5 pct bentonite. The degree of reproducibility of results shown by the curves in Fig. 7 is considered to be satisfactory.

Test blocks composed of Arnolds 26A sand with 5

pct bentonite and 3 and 5 pct moisture were pressed to various densities, and the effect of ramming density in the green and dry state on the load induced in the casting at different times after pouring is shown in Figs. 8 and 9. The curves show that for identical densities dry sands restrict the contraction of the casting more than green sands and so induce higher loads in the casting. The amount of load induced in the casting at similar time intervals after pouring increases as the green or dry density of the sand compact is increased, and the load is induced earlier after pouring with the higher density compacts.

Figure 8 shows that it is possible for a green-sand compact having a high ramming density to induce higher loads in the casting than a dry-sand compact having a lower density, even though the dry sand has the greater compressive strength at room temperatures.

The load values taken from the curves (Fig. 9) at time intervals of 55, 75, and 105 sec after pouring were plotted against the respective compressive strengths and densities of the compact and are shown in Fig. 10. It can be seen that as the density, and therefore the compressive strength, of green- and dry-sand compacts increase, the compact offers more resistance to contraction and induces higher loads in the casting. It is noticeable that with green-sand compacts no load is induced in the casting 55 sec after pouring, and only a slight load (max. 5 lb) is induced by dry-sand compacts.

The loads due to hindrance to contraction by green- and dry-sand compacts cannot be plotted on the same curve, because in some instances higher loads are associated with the green-sand compacts, even though the dry-sand compact has the higher compressive strength. For example, 75 sec after pouring a green-sand compact (1.52 g/cc density) having a compressive strength of 10.2 lb/sq in. induces a higher load in the casting than a dry sand (1.31 g/cc density) with compressive strength of 62.0 lb/sq in.

The amount of load induced in the casting at any

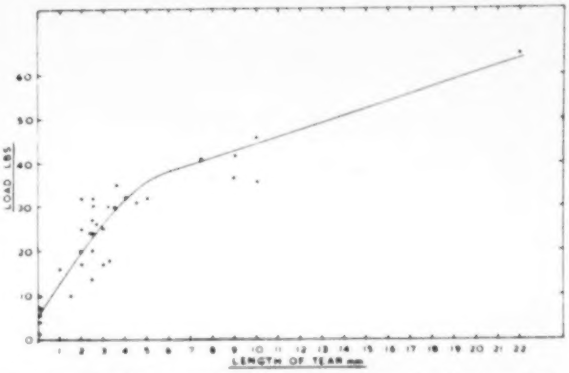


Fig. 6—Hindrance and hot tearing 75 seconds after pouring.

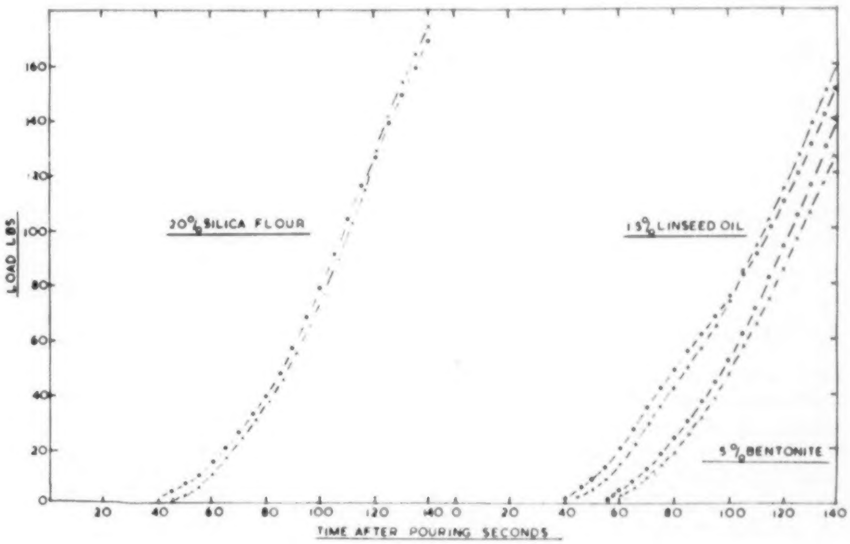


Fig. 7 — Reproducibility of hot tearing test was checked as shown here before investigation of variables was started.

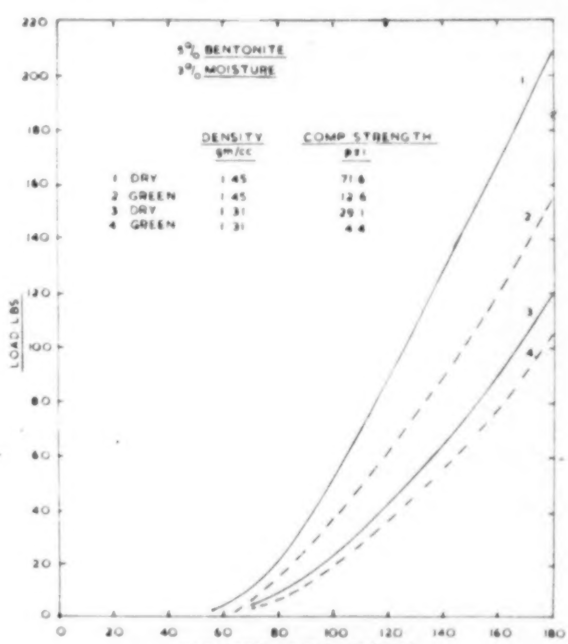


Fig. 8—Effect of ramming density of green and dry sands.

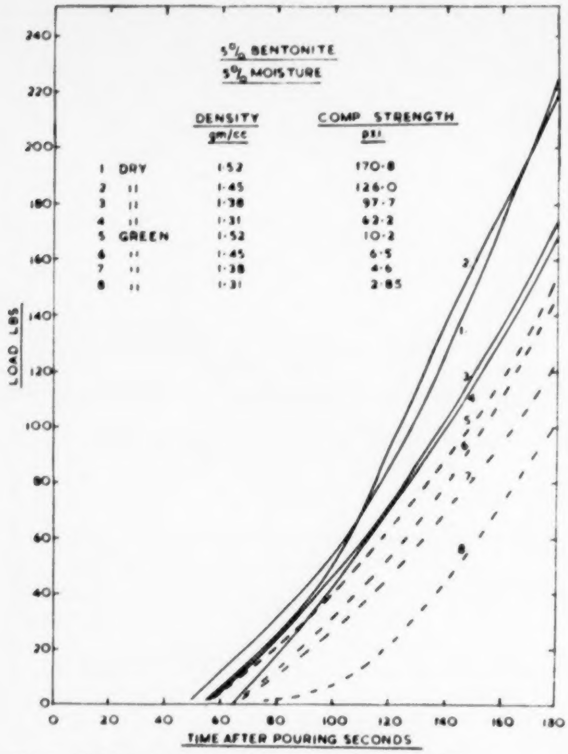


Fig. 9—Influence of density with higher bentonite.

time after pouring is governed by the amount of hindrance to movement of the runner that may be offered by the test block and must, therefore, be controlled by the strength properties of the test block.

A depth of sand in the test block, depending upon the time after pouring, is heated to a high temperature [above 1300 C (2372 F)] and will have low strength, while a much greater depth will be heated to temperatures beyond 100 C (212 F). For example, 75 sec after pouring, sand to a depth of at least 0.65 in. is at a temperature above 100 C (212 F). This depth of sand (0.65 in.) if of similar density should then have identical strength properties irrespective of whether it was originally a dry- or green-sand mix, and higher strengths in this depth of sand should be associated with higher density compacts.[4]

The strength of the cooler portion of the test block will also be effective in influencing the hindrance to contraction offered by the block. If it is very weak it will deform along with the hot portion of the block, and therefore the test block as a whole will have low resistance to contraction. However, if the cooler portion is relatively strong, it is possible that the contraction of the test bar will be resisted mainly by that portion of the test block which is at a high temperature, and therefore weaker.

The amount of hindrance to the contraction of the casting that is offered by the test block will thus depend upon the relative strengths of the hot surface layers and the cooler interior of the test block. A sand compact having moderate room temperature strength, but capable of developing a high hot strength, will restrict the contraction of the casting more than a sand compact having a high room temperature dry strength but a low hot strength. This will be especially so during the first few moments after pouring, when high temperatures are attained at the surface of the test block and when the amount of contraction which the casting can undergo is small.

Sections taken through the junction of the runner and the bar showed that small tears were present in only those castings that were restrained with the higher density (1.52 g/cc) green- and dry-sands compacts (Figs. 11 and 12). The castings restricted with those green- and dry-sand compacts having lower densities were free from tearing at this position, a typical example being shown in Fig. 13.

Effect of Amount of Bond

To determine the effect of variations in the amount of clay bond, a series of tests was carried out using

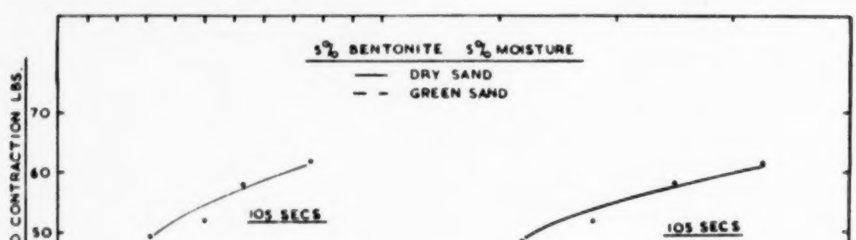
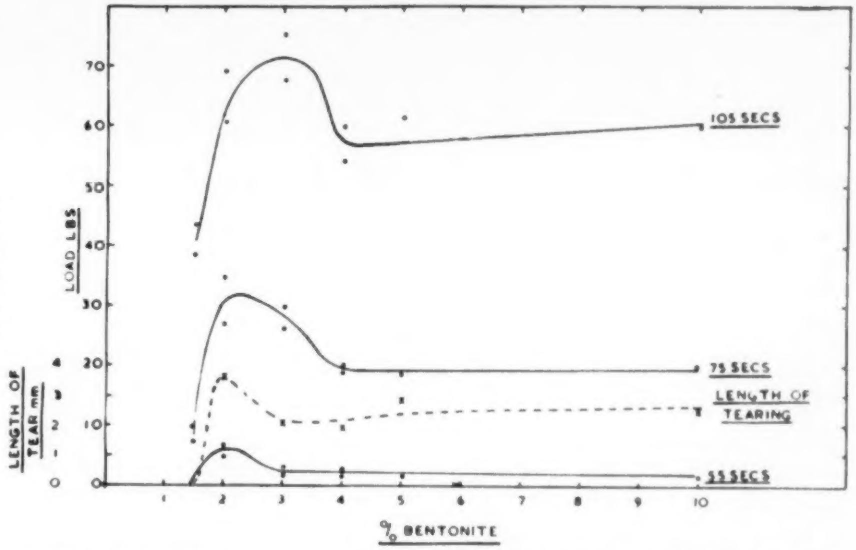


Fig. 10—Resistance to contraction of casting is higher the greater the density and compressive strength for both green and dry sand. Data are replotted from Fig. 9, on this page.

Fig. 14—*Greatest resistance to contraction, measured by tests reported here, came at bentonite contents of 2 to 3 per cent. Increased bentonite reduced the resistance but not to low level found at 1.5 per cent.*



test blocks composed of Arnolds 26A sand containing different amounts of bentonite from 1.0 to 10.0 pct. All blocks were pressed to the same density, 1.45 g/cc, and the moisture content was held constant at 3.0 pct with the exception of the 10.0 pct bentonite mix, which contained 5.6 pct moisture. The blocks were tested in the dry condition, and the details of compressive strength, are given in Table 2.

The curves in which the loads due to hindrance to contraction are plotted against percentage bentonite additions, at time intervals of 55, 75 and 105 sec after pouring, are shown in Fig. 14.

As can be seen from the curves, higher loads, and therefore greater resistances to contraction, are associated with the blocks containing 2.0 to 3.0 pct bentonite. An increase in bentonite from 3 to 4 pct causes a lowering of the test block's resistance to contraction, but further increases to 5.0 and 10.0 pct have little effect. The test block containing 1.5 pct bentonite offers the lowest resistance to contraction in the range investigated.

Also included in the graph (Fig. 14) is a curve showing the extent of tearing associated with each percentage addition of bentonite. It will be noted that the longest tears are found in the casting restricted by the block containing 2.0 pct bentonite, and that no tears were found in the casting held by the test block containing 1.5 pct bentonite.

The reason for this maxima in the load and tearing curves at 2.0 and 3.0 pct bentonite is not apparent. It may be due to differences in the distribution of the bond with varying bentonite contents, but further work is necessary before a satisfactory explanation can be given.

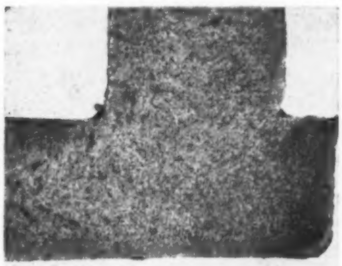


Fig. 11 — Tear in casting restrained by green sand test block rammed to a density of 1.52 g/cc and bonded with 5 pct bentonite.

Fig. 12 — Tear in casting restrained by dry sand test block rammed to a density of 1.52 g/cc and bonded with 5 pct bentonite.

Fig. 13 — Tear-free casting restrained by a dry sand test block rammed to a density of 1.38 g/cc and bonded with 5 pct bentonite.

Effect of Sand Grain Size

Tests were carried out on three sands having different grain sizes (details of gradings given on Table 1), the mixes containing 5 pct bentonite and 3.0 pct moisture. The blocks were pressed to densities that resulted in similar strengths in the dry condition, and the details of compressive strengths are given in

TABLE 2

	Test Blocks					
	I	II	III	IV	V	VI
Bentonite, %	1.50	2.0	3.0	4.0	5.0	10.0
Moisture Content, %	3.0	3.1	3.1	3.3	2.8	5.6
Load for compaction, psi	231.0	191.0	145.1	134.4	121.0	42.2
Dry strength, psi	64.0	77.5	77.8	97.8	71.6	111.0

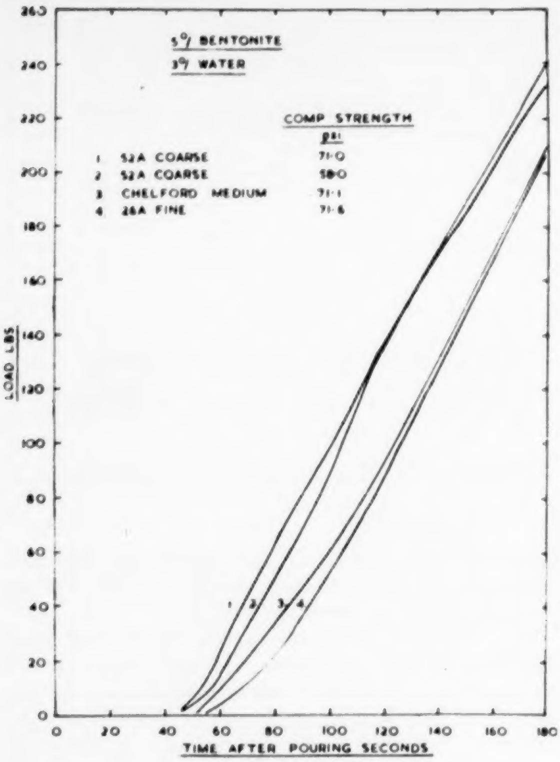


Figure 15

Table 3. The loads induced in the castings at various times after pouring for the four compacts are shown in Fig. 15.

TABLE 3

Sand	Moisture, %	Density, g/cc	Load for Compaction, psi	Dry Strength, psi
Fine				
Arnolds 26A	2.8	1.45	121.0	71.6
Medium				
Chelford	3.2	1.49	35.0	71.1
Coarse				
Arnolds 52A	3.1	1.55	173.0	70.0
	3.0	1.52	74.0	55.5

Editor's Note — Mr. Middleton's paper, which was presented in its entirety at the American Foundrymen's Society 1953 Convention by C. W. Briggs, Steel Founders' Society of America, Cleveland, is too lengthy for complete inclusion in this issue. The paper has been pre-printed (No. 53-70) and will appear in the 1953 edition of Transactions. However, since Mr. Middleton's paper offers a comprehensive coverage of the entire problem of hot tearing as influenced by molding materials—a subject of vital concern to steel foundrymen everywhere—the article will be concluded in the July issue of AMERICAN FOUNDRYMAN.

RECOMMENDED NAMES FOR GATES AND RISERS

Prepared by the GATING AND RISERING COMMITTEE, GRAY IRON DIVISION, AMERICAN FOUNDRYMEN'S SOCIETY

This chart has recently been published by the Gating and Risering Committee, Gray Iron Division, A.F.S., as a general guide for gray iron foundry terminology. Containing accurate definitions of the more common nomenclature, it is a valuable reference for newcomers and veteran foundrymen. Available also in pamphlet form. In either form, the price is 25c to all A.F.S. members, and 40c to non-members. Write national headquarters for information.

Paris Congress and Tours Attract Many Foundrymen

The American foundry industry will be well represented at the International Foundry Congress to be held at Paris, September 19-26, 1953.

Foundrymen and their wives from all sections of the United States have been making reservations for the Congress, and for the three European tours that have been arranged for their convenience.

As an indication of the enthusiasm shown by American foundrymen, reservations are still being received. As of May 15, the following reservations had been made.

PRE-CONVENTION TOUR A. England—Belgium—Southern Germany and the Rhine — Switzerland and the Alps—Paris and Chateau Country.

Mr. and Mrs. Joel C. Farrell, Vice-President and General Manager, Farrell-Cheek Steel Co., Sandusky, O.

Mr. and Mrs. M. W. Goldberg, President, Modern Equipment Co., Port Washington, Wis.

Mr. and Mrs. William Klein, Vice-President, Robberson Steel Co., Oklahoma City, Okla.

Mr. and Mrs. S. C. Massari, Technical Director, American Foundrymen's Society, Chicago.

Mr. and Mrs. Dominic Meaglia, Manager, American Foundry, Los Angeles.

Mark E. Stratton, Vice-President in charge of sales, Mountain State Steel Foundries, Parkersburg, West Va.

PRE-CONVENTION TOUR B: Italy—Switzerland — France — Belgium — Holland—England.

Mr. and Mrs. T. L. Arzt, President, T. L. Arzt Foundry Co., Chicago.

Mr. and Mrs. F. M. Fahrenwald, President, The Fahralloy Co., Harvey, Ill.

Mr. and Mrs. Lawrence J. Gallagher, General Manager, Dayton Malleable Iron Co., Ironton, O.

Mr. and Mrs. Sam D. Russell, President, Phoenix Iron Works, Oakland, Calif.

Mr. and Mrs. B. J. Sayles, Jr., President, Calorizing Co., Pittsburgh.

POST CONVENTION TOUR D: Paris—The French Riviera—Italy—Switzerland—Black Forest and the Rhine—Brussels—England.

Mr. and Mrs. T. H. Benners, Jr., Partner, T. H. Benners & Co., Birmingham.

Mr. and Mrs. C. L. Carter, President and General Manager, Albion Malleable Iron Co., Albion, Mich.

Mr. and Mrs. Joseph O. Danko, Vice-President, Arlington Bronze & Aluminum Corp., Baltimore.

Mr. and Mrs. Harry W. Dietert, President, H. W. Dietert Co., Detroit.

Mr. and Mrs. William G. Ferrell, Vice-President in charge of manufacturing, Auto Specialties Mfg. Co., St. Joseph, Mich.

Mr. and Mrs. George I. Gilson, President, J. E. Gilson Co., Port Washington, Wis.

Mr. and Mrs. L. D. Harkrider, President, General Malleable Corp., Waukesha, Wis.

Mr. and Mrs. C. E. Koehler, President and Treasurer, Hamilton Brass & Aluminum Castings Co., Hamilton, O.

Mr. and Mrs. Edward T. Korten, President, Reliable Castings Corp., Cincinnati, O.

Mr. and Mrs. Arthur Kuhn, Secy-Treas., Reliable Castings Corp., Cincinnati, O.

Mr. and Mrs. Frank Kulka, Secretary, Motor Castings Co., Milwaukee, Wis. **(Miss M. Kiekhofer** also in party.)

Mr. and Mrs. Dan L. La Marche, Vice-President, American Malleable Castings Co., Marion, O.

Mr. and Mrs. William W. Maloney, Secretary-Treasurer, American Foundrymen's Society, Chicago.

Robert S. Nobles, Vice-President, Mountain State Steel Foundries, Parkersburg, West Va.

Mr. and Mrs. Robert E. Pheiffer, Asst. Secy-Treas., Farrell-Cheek Steel Co., Sandusky, O.

Mr. and Mrs. R. W. Phelps, Owner, Otaco, Ltd., Orillia, Ont.

Mr. and Mrs. W. Schaffner, American Malleable Casting Co., Marion, O.

Mr. and Mrs. L. N. Shannon, Vice-President, Stockholm Valves & Fittings, Birmingham.

Mr. and Mrs. Thomas H. Shartle, President, Texas Electric Steel Casting Co., Houston, Tex. **(Mrs. C. M. Taylor** also in party.)

Mr. and Mrs. R. J. Teetor, Cadillac, Mich.

Mr. and Mrs. John Wagner, President, Wagner Malleable Iron Co., Decatur, Ill.

Mr. and Mrs. I. Richards Wagner, Retd. President, Electric Steel Castings Co., Indianapolis, Ind.

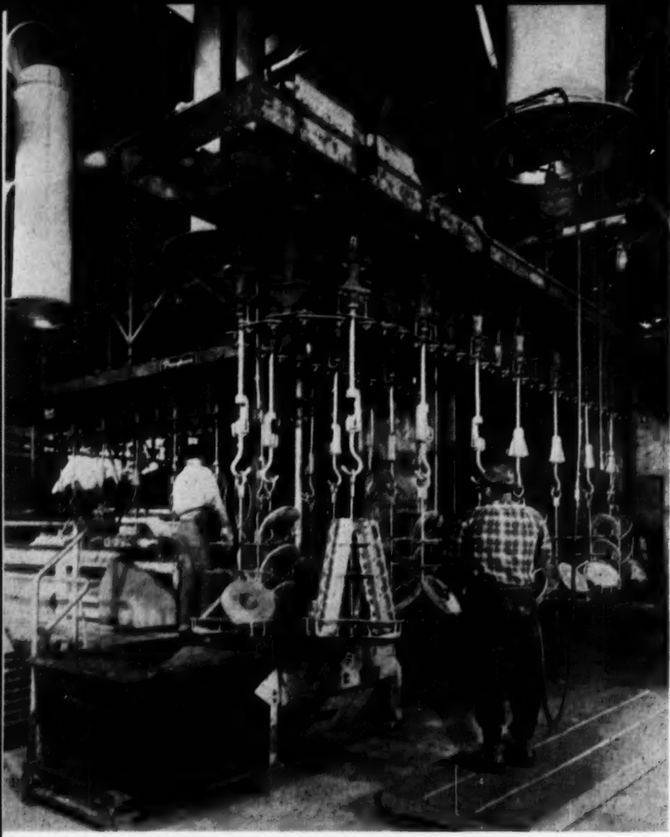
Mr. and Mrs. C. S. Wieland, President, Mid-City Foundry Co., Milwaukee.

Mr. and Mrs. C. W. Williamson, Vice-President, Trinity Valley Iron & Steel Co., Fort Worth, Tex.

UNSCHEDULED:

Mr. and Mrs. George Euskirchen, President, Cincinnati Foundry Co., Cincinnati, O.

Mr. and Mrs. W. F. Lange, President, Casting Service Corp., La Porte, Ind.



Shot blast No. 3 at Ford Cleveland Foundry, used principally for cylinder block heads, loaded 3 to a hook.

America's largest production foundries. A significant point which serves to substantiate the advance design of the foundry is the fact that approximately 10 per cent of the total cost of the completed plant was spent for ventilation, dust arresting and smoke abatement equipment. This expenditure has resulted in an operating foundry which is second to none in cleanliness.

The foundry and engine plant are located on the same plot of 112 acres, approximately 10 miles from the center of Cleveland. The main foundry building is 1390 ft long and 540 ft wide and has 1,200,000 sq ft of floor area, including the basement. The foundry will melt 1,800 tons of metal daily—to be expanded to 2100 tons production. Eight molding lines use about 24,000 tons of sand per day through recirculating sand systems. Indoor sand storage bins hold 54,000 tons. The ventilating system is designed for five to six air changes per hour, requiring the circulation of approximately 3,000,000 cu ft of air per minute. At capacity operation, the foundry employs about 3,500 workers.

Types of Operations

Operations in the cleaning room can be divided into three broad categories: (1) cylinder blocks; (2) cylinder heads; (3) small parts.

Cylinder block castings enter the cleaning department at the southwest corner of the building and travel along the west wall to the first operation—opening locating holes on the tops and water openings on the ends and tops of the blocks. After this step is

Ford Foundry Cleaning Room Features Planned Efficiency

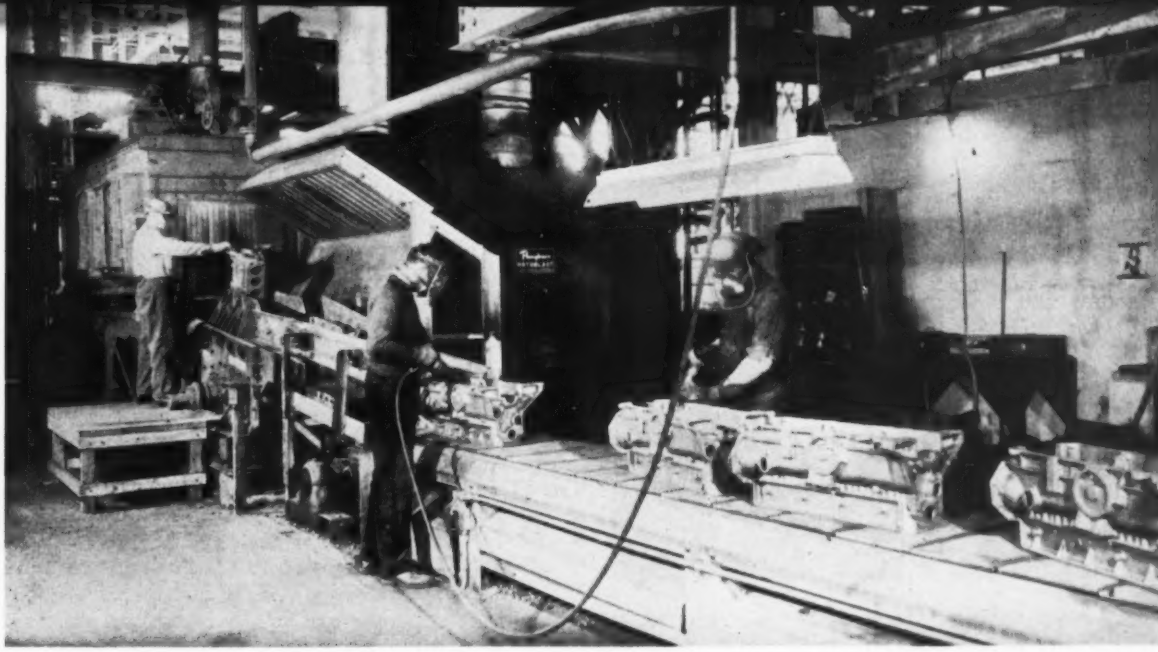
V. F. Stine / *Vice-President, Pangborn Corp., Hagerstown, Md.*

When the Ford Motor Company decided to build its great new Cleveland foundry, a basic principle was established to guide the planning. This new foundry was designed to produce high quality castings with the most modern of mechanized equipment and in surroundings providing the finest possible working conditions. This story shows how the principle was followed in the cleaning room.

■ This particular foundry handles the casting of engine cylinder blocks, heads, flywheels, intake and exhaust manifolds, flywheel housings and other parts for 6-cylinder Ford engines and 8-cylinder V-type Mercury engines. While it is not the largest foundry in the country from the standpoint of current output, it is certainly the most modern and undoubtedly one of

completed, the blocks are deposited, crank case side down, on plate conveyors. They are carried to roll-over shake-out equipment, which swings the blocks up on end and deposits them on hooded, vibrating grids. Side plates hold the castings in vertical position, after which they are dropped to a point where the tops of the blocks rest on grids. This operation removes the sand which forms water jackets in the blocks.

At the next station, an air hammer is used to knock off excessive fins which might interfere with the automatic grinders. Grinding follows with a slight difference in grinding procedure for the 6- and 8-cylinder blocks. The 8-cylinder blocks, with crank case side up, are ground in a special machine connected to an exhaust system. Six wheels are used to grind the end of

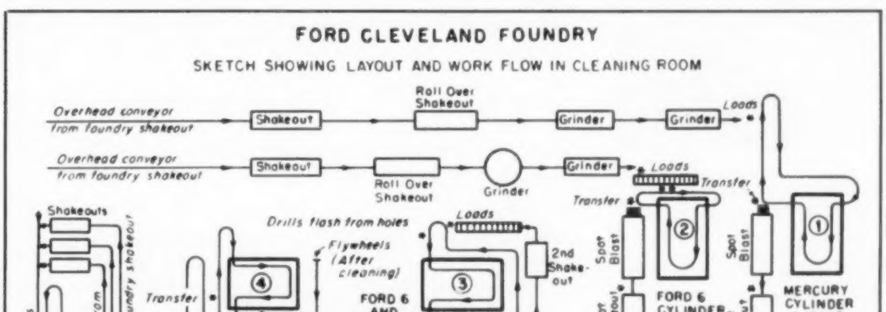


Six-cylinder block casting emerges from the spot blast, passes through abrasive shake-out before going to continuously moving slat conveyor, past both the chipping and the grinding stations, in Ford cleaning room.

the crank case and the two ends of the block. The blocks then emerge onto a conveyor, where they are turned so that the tops of the cylinders are up and center lines parallel to the line of travel. Next, they pass through a hooded grinding machine which faces off the tops of the cylinders. The blocks are then picked up and hung on hooks suspended from an overhead chain conveyor, which carries them through a special six wheel shot blast cleaning machine where all scale and burnt sand is removed.

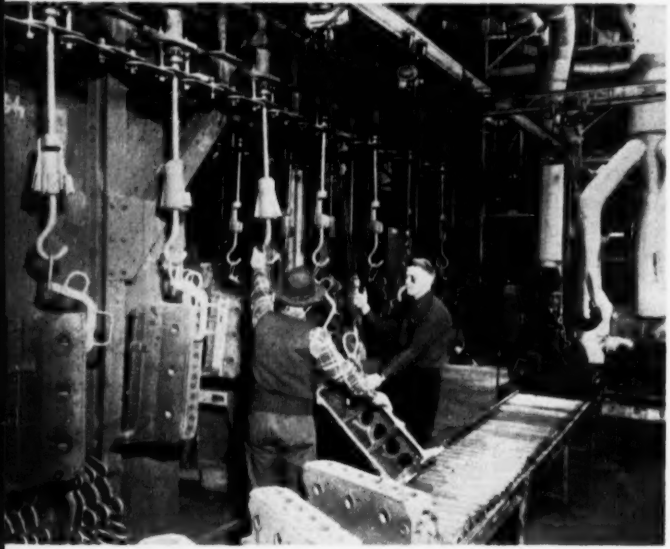
Different equipment is used to grind the 6-cylinder blocks. These are placed on a 15-ft. diameter rotary table which contains six holding fixtures to maintain the blocks in a vertical position. This grinder is designed so that the blocks can be surface ground on the top and bottom simultaneously.

The blocks are then taken off the rotary machine and moved on a conveyor to a two wheel grinder which grinds both ends of the block at once. The next step is to hang the blocks on hooks and send them through a continuous shot blast cleaning unit. One of these units is used only for 8-cylinder blocks, the other for 6-cylinder blocks. These two pieces of equipment operate as follows:



Floor plan of the cleaning room at Ford Motor Company's Cleveland Foundry. Note progression of castings from shakeout room at left. Facilities are installed for handling cylinder blocks for both Ford 6 and Mercury.

Nine-foot airless blast table used to blast clean heads on which welding has been necessary during production.



Shot blast machine No. 2 at Ford Cleveland Foundry, used to clean cylinder blocks for Ford 6-cylinder engines.

Shot blast No. 1 is a monorail conveyor machine with six airless blast units which clean Mercury V-8 cylinder blocks at a rate of 240 per hour. It is scheduled to operate 16 hours a day on two shifts. Each Mercury cylinder block will pass through the machine on an overhead conveyor, one cylinder block per hook. Since the Mercury block weighs 184 lb, the tonnage cleaned adds up to about 22 tons per hour. A spot blast machine utilizing four airblast nozzles, is located alongside the cabinet of the No. 1 machine. As the cleaned castings leave the main cabinet, they are placed in the spot blast by a mechanical loader, pass through it and go on to the shot shakeout. Then, by conveyor, they move on to the chipping and grinding line.

Shot blast No. 2 is an identical piece of equipment, but will handle Ford 6-cylinder engine blocks at the rate of 240 blocks per hour. A spot blast machine is located alongside No. 2 as in the case of No. 1. The Ford cylinder block weighs 175-3/4 lb and is cleaned one block per hook. Tonnage cleaned by this machine amounts to approximately 21 tons per hour.

Roller Conveyors Used

After shot blasting has been completed, both 6- and 8-cylinder blocks are transferred from overhead conveyor hooks to roller conveyors which move them to the spot blast units. Blocks then move out from spot blast through an abrasive shake-out unit and onto a continuously moving slat conveyor which carries them through chipping and grinding stations.

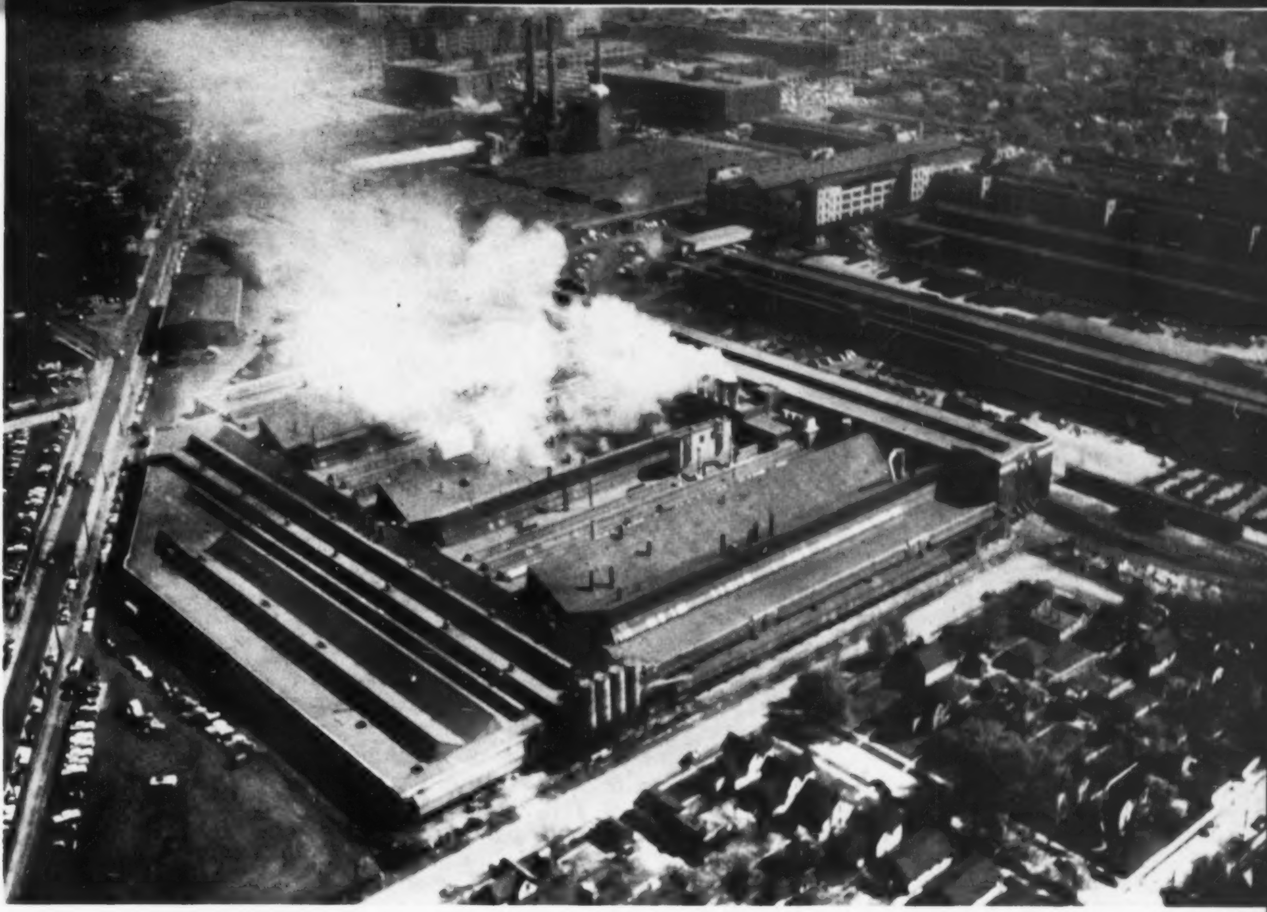
Heads for the 6- and 8-cylinder blocks are carried into the cleaning department on an overhead conveyor suspended on cradle hooks. They are removed from the conveyor, placed on a shake-out and then moved on to a short, slat conveyor. At this point they are picked up and placed on special hangers suspended from another overhead monorail conveyor for the trip through shot blast No. 3.

Shot blast No. 3, a similar machine, has six airless blast units which are used to clean Ford 6 and Mercury cylinder heads. These two types of heads enter the machine indiscriminately and are sorted after cleaning and routed from the machine by way of separate conveyors past separate chipping and grinding lines. At present, this machine is used for Ford 6 heads and flywheels. The heads weigh 66 lb and are loaded 3 to a hook. The machine is set to travel at a speed which will clean three hooks per minute or 540 heads per hour, a total of nearly 18 tons per hour.

Shot blast machine No. 4 and 5 are used to clean flywheels and intake and exhaust mainfolds. At first, it was planned that one machine would clean one part exclusively. However, all classes of work, known as small parts, now go through both machines. Each monorail hook will hold either six flywheels or six manifolds. Weight of the flywheel varies from 37 lb for the Ford 6, to 41 lb for the Mercury. Ford 6 manifolds weigh 14 lb (intake) to 16-¾ (exhaust). Mercury manifolds weigh 22 lb for the intake and 9 and 10-1/2 lb for the exhaust.

All of the overhead monorail shot blast cleaning machines are equipped with two-speed drives. This type of drive provides for a slow speed as the castings rotate on their hooks and pass through the blast streams from each blast wheel, and a faster speed as the machine indexes between cleaning stations. The blast cleaning production of the five machines totals 80 tons per hour.

There are also two special airblast machines designed as combustion chamber blasts. The purpose of these machines is to guarantee that tne combustion chambers are of exactly equal volume. If inspection indicates that one or more combustion chambers are smaller than required, a reciprocating nozzle and timer arrangement blasts out sufficient metal to equalize the volume. However, spot checks have revealed that there has been no necessity for this operation so far.



Industry and the Community: A Reciprocal Relationship

JAMES R. ALLAN / *Chairman, Steering Comm., Safety & Hygiene & Air Pollution Program*

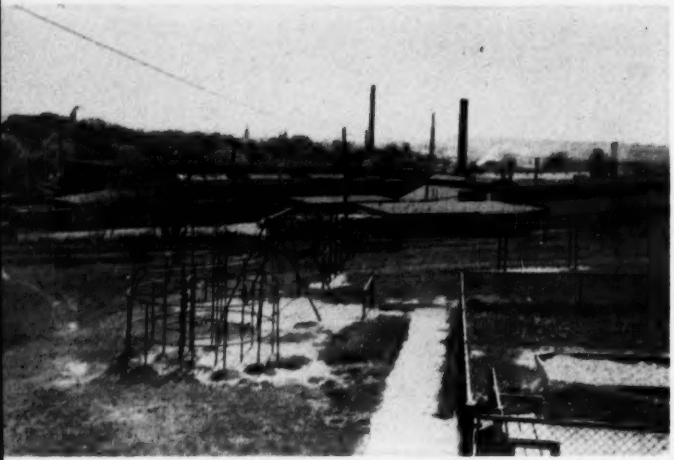
A new concept of the rights of industry to freedom from harassment by residential neighbors under certain conditions is brought out in this discussion of the foundry industry's progress toward safer, cleaner shops and cleaner air. This and other guideposts for foundry industry thinking have been set up in this report of the Steering Committee of the A.F.S. Safety & Hygiene & Air Pollution Program presented during the 1953 A.F.S. Convention.

■ THE A.F.S. can well be proud of the accomplishments to date of its newest venture in the field of safety, hygiene and air pollution.

The Society's determination to revitalize the original program on health and safety, which was on a voluntary basis, to that of a regularly employed staff to supervise and broaden out the program has been fully justified. While this new venture did not get under way until August 1951, much had been accomplished in the initial studies and approaches to problems of safety, hygiene and air pollution that is most valuable.

It is believed that no other organization in the country is anywhere near attempting such constructive work to find answers to the related problems of safety, hygiene and air pollution that are not only confronting the foundry industry, but a large segment of all industries.

Don't be misled by statements that the efforts to date have resulted in too many concrete solutions to the foundry's numerous problems, because there is a tremendous task of evaluating causes and effects before technical approaches can be made to recom-



Intelligent approach to the pollution problem can make industry a good neighbor, as in this view of an operating foundry immediately adjacent to a playground.

mendations for correction. Nevertheless, two reports, dated November 10, 1952, and March 18, 1953, by William N. Davis, director of Safety & Hygiene & Air Pollution, and addressed to the A.F.S. Board of Directors, clearly indicate the accomplishments and the realistic approach to various phases of the activity.

We cannot over-emphasize the high caliber of men serving on the various committees that have been working cooperatively under the director of the Program and the Steering Committee. The Committee personnel is composed of men of long experience in operating procedures, engineering, safety, industrial hygiene and other phases of activity in foundries and industry generally. They are the best in the field, and the firms they represent are cooperating so that the program may be carried on for the benefit of all.

Such a program requires money to operate. Contributions from foundries and allied industries to support this safety, hygiene and air pollution program are coming in, but the fund is far from the goal necessary to carry the program on over an extended period of time. The Society must have the contributions of all companies now. Any contributions made will be well repaid in the technical answers developed. These answers are going to be a guide, and help the foundry to be a *better place in which to work and also be a desirable neighbor in the community.*

Foundry Problems

Certain problems confronting industry should again be emphasized because they are becoming more acute.

The A.F.S. Training Course on the Fundamentals of Foundry Safety is now well organized and the Committee has conducted or cooperated in several programs. This is a good start, but such activities must be broadened to take in small localities where local small industries and others must better organize themselves for more technical programs on health and safety matters.

Organized labor has charged that accident rates are still too high, particularly in the smaller industries, and that the smaller industries are doing little or nothing about the problem of promoting healthful working conditions and instituting safe practices. There are definite indications that possibly by legislation the labor group is going to compel industry to do something about the problem.

Industry very definitely has been doing something about the problem, and the records support this. Certainly a stepped up program in the small industrial areas around the country through the medium of the Chamber of Commerce, trade and technical organizations employers' groups, etc., would serve a very good purpose, and A.F.S. can contribute suggested programs and cooperate in many ways. It should be emphasized, however, that the initiation of these programs rests entirely with management of local foundries and industry at the community level.

Supplies Manuals

The Society can in no way enter into legislative matters or the underwriting of regulatory codes at state level. Nor does the Committee feel that A.F.S. would ever want to enter this field. Nevertheless, the Society's Safety & Health & Air Pollution program can supply recommended Good Practices Manuals and technical information to foundries that are working with legislative or regulatory organizations. Especially where regulatory health and safety codes are involved, such information would be of great value in determining the proper approach to the local problem. As rapidly as possible, the present recommended Good Practice Manuals are being reviewed in order to bring them up to date where necessary, and new manuals covering additional subjects are being initiated.

Trends in the field of noise abatement, primarily inside the foundry, factory, or work shop, must be carefully followed. These factors can be very serious and expensive to industry generally if extreme legislation is adopted without all of the factors being fully understood, studied and evaluated. A common-sense approach to the problems must be inaugurated to protect both the community and the industry.

Noise is under study by the Committee. Full cooperation with all agencies working on the problem, as well as a complete study of the over-all problem, is urged.

Air pollution is probably the greatest problem facing industry today, particularly for heavy industry and foundries. It is not a new problem. It has existed for centuries. Back in the 12th century, a coal smoke offender could be beheaded in England. There is a great deal of hysteria on this subject today, many laws and regulations are being passed, damage suits initiated, and industry in general is being harassed.

A New Approach

A close study of the over-all problems seems to indicate that it is about time for industry to assert itself and demand a more intelligent approach to the situation. As the author sees the situation, the remedy may call for a revision in legal thinking—a new concept of laws for determination of the rights of property owners. If this revision in attitude to the

Panel discussions, such as this session at the recent A.F.S. Convention, can lead to alleviation of the problem. Shown, from left: J. G. Liskow, American Air Filter Co.; J. R. Allan, International Harvester; H. T. Walworth, Lumberman's Mutual Casualty Co.; W. W. Dodge, Caterpillar Tractor Co.; and W. N. Davis, A.F.S. Director of Safety and Hygiene and Air Pollution. Mr. Allan presented his paper at this particular session.

concept below is not accomplished, industries too hard-pressed within urban areas, will be forced to relocate outside of city boundary lines in more isolated areas. New industries looking for plant sites will certainly go to the wide open spaces, resulting in less taxable property in the corporate areas.

Program

In evaluating the problem today, the writer feels that the following program is necessary and should be given serious constructive thought:

1. Industry must be responsible for minimizing the amount of effluent discharged from chimneys, dust arrestor systems and other operations tending to create air pollution. The word *minimize* is used purposely, because no type of dust arrestor or collector equipment used to capture particulate matter is 100 per cent efficient. Effectiveness of such devices will probably range from 50 to 90 per cent, depending on a great many factors, plus the very important one of capital cost which may be prohibitive in certain cases.

While the dust arrestor industry is trying to develop better equipment all of the time, every type and make has its limitations and there is certainly room for a great amount of research and study in the field to improve them. High capital expenditures for arrestor equipment installation for some operations, forced on an employer by arbitrary regulatory authority, can cause the industry to close up shop or leave the area. This may happen in a number of instances if industry is pushed too far.

Industry should be required to control and minimize the air pollution it is directly responsible for, but there are, of necessity, two steps or stages in such a program while waiting for the satisfactory development of better, more efficient and less costly equipment to capture the pollutants. The industry is at a stage now where it can apply collectors, arrestors or adopt control equipment to stacks, chimneys, or discharge outlets that can do a reasonably fair job of capturing pollutant matter—solids that is—within the limits of collection efficiency of applicable equipment available today.

2. The second stage which may be some years off—the most efficient collectors today have very serious limitations as to application, and involve terrific capital expenditure that the average factory or foundry cannot afford and stay in business—will come when research has developed new devices or improved the efficiency of existing equipment, and reduced the cost so that it is available without undue financial burden to the average employer. In this second stage of arrestor development, the successful capturing of such nuisances as smoke, fumes and odors probably would be achieved.

Noise and Dust

Any successful industry or foundry, regardless of the size of the plant, means human and business activity over one, two or three working shifts in the 24-hour day. There is the constant flow of motor trucks and railroad movements . . . employes' automobiles in and out of the plants . . . some materials have to be handled by cranes. All create a certain amount of dust as well as noise. Certain types of operations within the shops create vibration and noise because of the very nature of the operations. All of these activities must go on—hence it becomes somewhat of a nuisance where home owners are allowed to build or to live in the adjacent areas.

These are very real and vital considerations that regulatory authorities, home owners and the public must recognize and understand or some day find

themselves with little or no industry to support their communities. This calls for legal protection to an owner of a business who has taken every reasonable precaution and provided equipment available to him, within his ability to pay, against law suits for property damages or alleged violation of ordinances that are out of step with practicality.

Zoning Plans

Certainly government, city planning commissions, zoning commissions, chamber of commerce groups and similar organizations must review their city-wide zoning plans and take steps to modify them to the extent that industrial areas are surrounded by buffer areas —such buffer areas possibly being comprised of light industry and/or commercial establishments to prevent home owners from building up against industry property lines or boundaries. If such areas cannot be provided physically, then the alternative is to create a legal buffer area where home owners will have no legal rights when industry is properly and reasonably conducting itself, taking into account all of the factors that go to comprise its operations.

Need Guarantees

Certainly, no new industrial firm should settle in a community unless it demands and obtains a reasonable guarantee against harassment, and that the community sets up buffer areas for its protection.

The forementioned ideas are quite revolutionary, but frankly industry is at a point where it must put up a strong fight against unwarranted harassment and penalties. This is a job for all foundrymen to handle at the local level. They should inform the local governments and the public what industry's problems are and the limitations of equipment and capital involved in being forced to do the impossible. It is possible for industry to take a militant attitude in this matter of air pollution for a sane approach to the rights of all involved providing industry applies all the reasonable controls available to it for minimizing air pollution.

The Minimum Effort

These recommendations that the foundries and industry generally begin to assert themselves for a broader understanding of air pollution problems, and in particular for that portion for which they are responsible, does not imply that such a position can be taken without doing everything reasonable to minimize air pollution effluents affecting the local area.

The management of a foundry, or any other industrial activity for that matter, must be sincere in the effort to be a good neighbor, and the following ideas are suggested as a part of any program for the abatement of air pollution:

1. If a new industry that will have certain air pollution problems is looking for a location on which to build, it is wise to select a site isolated from residences and dwellings. This step generally means keeping out of urban areas.
2. Initiate educational programs designed to train employes in the proper use of equipment and processes for controling air pollution.
3. Inaugurate good housekeeping programs in the plant. Such programs are usually half the battle in any campaign for safer, more healthful working conditions, and this applies to quite an extent in air pollution matters.
4. Institute good maintenance program. A lot of money can be spent on dust arrestors and other devices and means for controlling air pollution, but such equipment requires supervision, checking, and proper operation.
5. Don't overload dust arrestors and other devices installed for the capturing of air pollutants; provide additional equipment where necessary.
6. Be sure to know the limitations of any equipment or methods used for reducing the amount of pollutants in the discharge stack into the general atmosphere, that could give rise to complaints in the general area. Responsible vendors of equipment will give reasonable assurance regarding collection and operating efficiency under stated conditions. Watch for claims of operating perfection at low cost; these two elements do not go hand-in-hand.
7. Make an engineering survey on all operations and equipment that can cause air pollution complaints from the neighborhood, and determine what steps are necessary for better control of the situation from within the plant. In this connection, the S & H & AP Committee on Air Pollution Problems has developed a list entitled *"Check List of Foundry Operations which May Cause Air Pollution,"* that will be most helpful in making an engineering survey.
8. Add the subject of air pollution problems to local group meetings on health and safety. An exchange of ideas or experiences and practices will be beneficial, and many new ideas can be acquired that undoubtedly will have application in the various plants.

The plaque pictured here was sent to S. C. Massari, Technical Director, A.F.S., by Dr. Eng. Franz Grosser, president, Buderus Iron Foundries, Wetzlar, Germany, in the Western Zone. It was cast in fine sand and is an excellent example of close detail and high reproduceability.

Chesapeake Chapter Sponsors Course At Baltimore School

LEWIS H. GROSS / *Chairman, Educational Committee, Chesapeake Chapter*

SUNDAY, April 19th marked an important event in Chesapeake Chapter's history. The Board of Education of Baltimore City invited the Chapter to sponsor the Cast Metals course at its new Mergenthaler Vocational Technical High School. The first public open house for the school was held on that date.

It also marked the culmination of efforts of a chapter committee which, for more than seven years, had worked with the Association of Commerce and the School Board in planning and setting up the course. Their work being finished at this point, further duties were then delegated to the Educational Committee of the Chapter.

The Educational Committee arranged exhibits of patterns, cores and castings by local foundries and foundrymen were present to explain the various phases of metal casting operations. The different pieces of equipment were labeled to indicate the part where they function in producing castings.

The National Office of A.F.S. cooperated by sending a representative to help supervise the exhibits. Besides these duties, the representative, Ashley Sinnett, Michigan State College, together with the Educational Committee, held meetings with the various school board members in an endeavor to set up a curriculum for the course; and also to lay plans for furthering the Chapter's cooperation in the project.

Publications Exhibit

One of the exhibits was a complete set of A.F.S. publications, which later will be donated, through the Committee, to the Cast Metals Laboratory, in order to form a nucleus for a well-established metals library at some future date.

The Foundry Educational Foundation cooperated by supplying data for charts on foundry employment and production. Also, there were tracts explaining the functions of the FEF to high school students, and these were distributed to interested visitors.

Messages of congratulations on the opening of the new school were sent by the National Office to the Superintendent of Baltimore Schools, and to the principal of the new school.

In further planning for this new school, a special committee of the vocational department of the city schools toured all of the larger vocational schools of similar type, analyzing new equipment, methods and design for Mergenthaler. The result was an entirely new building which has already cost more than $7,000,000, making it one of America's most modern vocational centers. All of the vocational work for the white students will be centered in this one school.

The results for the school's 60 shops, laboratories, and numerous general purpose rooms, is a "broomless school" in which all floor waste, dust and trash is carried off through a hugh central vacuum cleaning plant.

Intercommunications

Any event, conference, or class, in any part of the school, can be transmitted to any other section or sections over a two-way public address system.

A windowless, 1000 capacity auditorium, a swimming pool, and boy's and girl's gymnasiums are some of Mergenthaler's new features.

To have succeeded in getting the Cast Metals School established in such a modern building would probably be the desire of any A.F.S. Chapter. The original committee, under C. A. Robeck, Chapter Secretary, is to be congratulated for the excellent duty performed.

During the open house day, more than 16,000 persons visited the school, and of these more than 5,000 jour-

Visitors showed interest in the displays at the public open house. Aluminum castings are being inspected at left.

neyed to the fourth floor of the Machinery Building to see the Cast Metals Laboratory.

Complete Equipment

When complete equipment has been installed, the laboratory will boast a full line of sand testing equipment, portable sand muller, jolt squeeze molding machines, an electric melting furnace, core oven, an airless blast cleaning machine, and the numerous steel flasks and usual small accessories.

The large, well-lighted and ventilated laboratory also contains a stock room, lavatory and a smaller bull-sessions room, together with the other modern facilities already noted.

Acceptance to any of the courses in the school is based upon aptitude test ratings given to students of junior high school level.

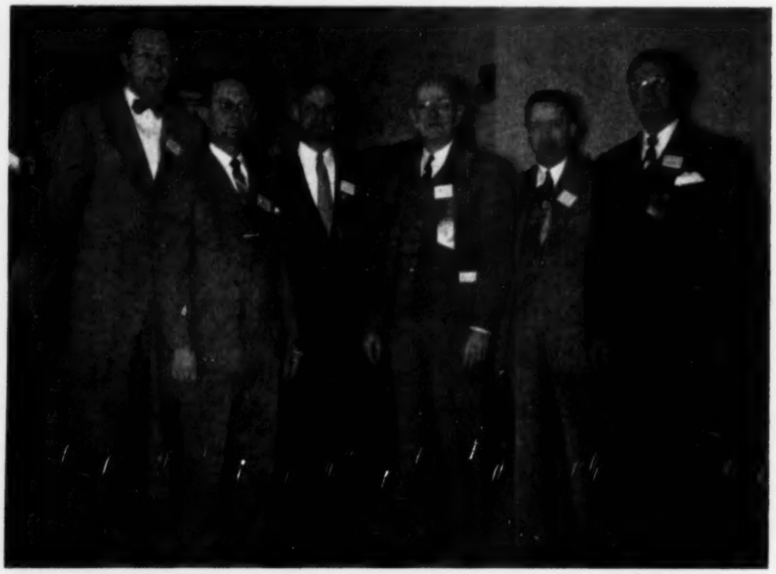
Those taking the Cast Metals course will use about half of their time in the laboratory, learning the fundamentals of sand and foundry molding technique. The balance of their class time will be used in the study of mathematics, English, history, elements of chemistry and physics, mechanical drawing, shop mechanics, mechanical laboratory testing, and pattern making, in a manner and degree as these subjects pertain to the foundry industry. The completion of the prescribed three-year course will enable the graduate to enter industry with a broad training in foundry fundamentals.

The Cast Metals Laboratory will also be used by the students of the coordinated subjects. Students from pattern making, mechanical drawing and general machine shop classes will be taught the fundamentals of the foundry trade.

More than forty-five per cent of the population of Baltimore City is directly or indirectly connected with the metal industry. The city's blast furnaces, electric melting furnaces, copper refinery, rolling mills, ship yards, airplane factories, tin can manufacturers, railroad shops, novelty makers, and foundries, produce and consume huge amounts of metals and metal products. It is the hope that this course will be the beginning of a well-established training school for the industry. This well-equipped school, with its modern facilities, should be an inspiration to those who study in it.

Chesapeake Chapter feels most happy and honored to have been invited to take part in such a worthy undertaking and it is the desire of the present Educational Committee to help in continuing the good work that has been started.

Ashley Sinnett (left) Michigan State College, represented A.F.S. National Headquarters in the Mergenthaler project. Lewis H. Gross, American Standard Corp., is Educational Committee Chairman for the Chesapeake Chapter.



Baltimore School Board representatives were present at the open house for the new school. From left: J. O. Proctor, Supervisor of Adult Education; G. E. Griefzn, Asst. Principal, Mergenthaler Vocational Technical High School; W. J. Hucksull, Supervisor of Vocational Industrial Education; Dr. C. L. Sylvester, Asst. Superintendent of Schools; M. P. Miller, Coordinator of Education and Industry; and H. E. Ziefle, Principal, Mergenthaler Vocational Technical High School.

Rebuild First Foundry

Re-creation of the three-century-old Saugus Iron Works, Saugus, Mass., is well on its way with the completion last summer of the replica of the original blast furnace and reconstruction of the old forge building expected to be completed by fall of 1953. First successful ironworks to be operated in the colonies, the plant dates back to 1646. It is being restored by the First Iron Works Association, Inc., with financial support of the American Iron and Steel Institute, and is scheduled for dedication as an industrial shrine the summer of 1954.

During the past four years, extensive exploration and reconstruction has been going on at the site and over five tons of relics have been taken from the ruins. The ironworks site is open to the public seven days a week. Visitors are welcome to tour the Iron Master's House, which has been completely refurnished with period pieces, visit a museum on the grounds, and view reconstruction activities from the restored charging bridge of the blast furnace.

Ode to a Patternmaker

The poem printed below was sent to us by E. J. McAfee, master patternmaker at Puget Sound Naval Shipyard. He had received it from Herbert J. McCaslin, the author, along with a copy of McCaslin's book, "Pattern Shop Practice," originally edited in 1907.

The Patternmaker

The drawing spread before him
His mind revolving schemes,
The Patternmaker studies his project
Seeking construction and molding
means.

If molded laterally, he mused
it eliminates a dry sand core,
Thereby lessening pattern cost
While adding to its molding more.

Back drawing the flange, he mused
Thru molding it in the drag,
Should give good results
Though it may the molder rag.

Hence the pattern was constructed
During an absorbing workday,
With every confidence in his belief
That he chose the efficient way.

Experiments on Spherulite Formation in Cast Iron

JACK KEVERIAN*, HOWARD F. TAYLOR**, AND JOHN WULFF***/
Massachusetts Institute of Technology

Nodular iron not only launched considerable discussion about its role in the field of castings, but also opened new avenues of research. The experiments described below were undertaken, in part, to find out whether the absence rather than the presence of something causes spherulite formation.

*Doctorate Candidate, **Professor of Mechanical Metallurgy, and ***Professor of Metallurgy, Head Metals Processing Division, Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

■ The experiments described herein stem from two separate and seemingly unrelated observations. Buttner, Taylor and Wulff[1] noticed that a normal gray iron gave a wetting contact angle against a graphite crucible; whereas a definite non-wetting contact angle was obtained if that iron were treated with magnesium. This change in wetting characteristics was attributed to an increase in the interfacial energy. They suggested a critical interfacial energy existed, above which spherulitic graphite was stable and below which flake

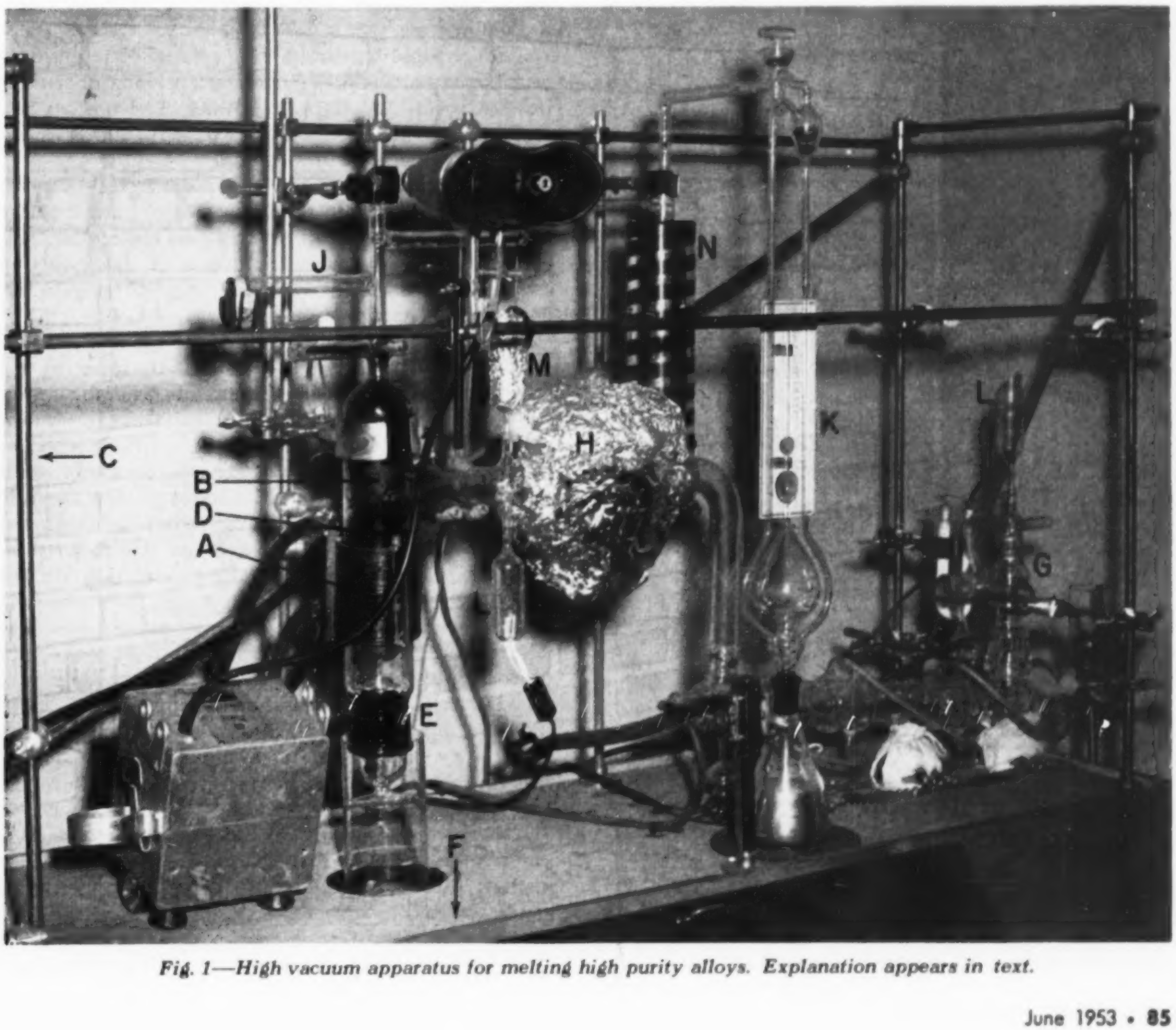


Fig. 1—High vacuum apparatus for melting high purity alloys. Explanation appears in text.

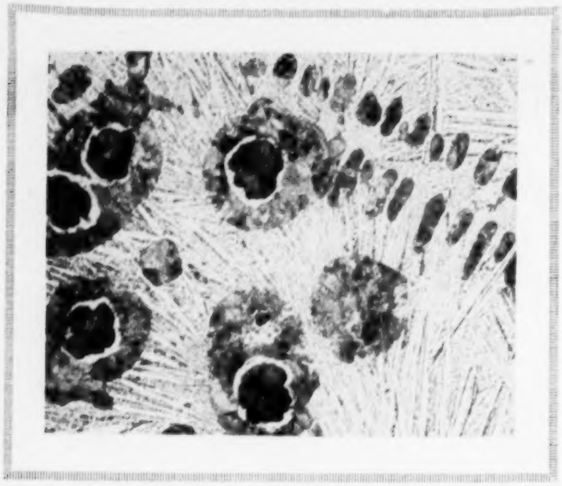


Fig. 2—Microstructure from central section of high purity Fe-C-Si alloy melted under vacuum (X 250 reduced 1/3).

Fig. 3—Microstructure of outer section of high purity Fe-C-Si alloy melted under vacuum conditions.

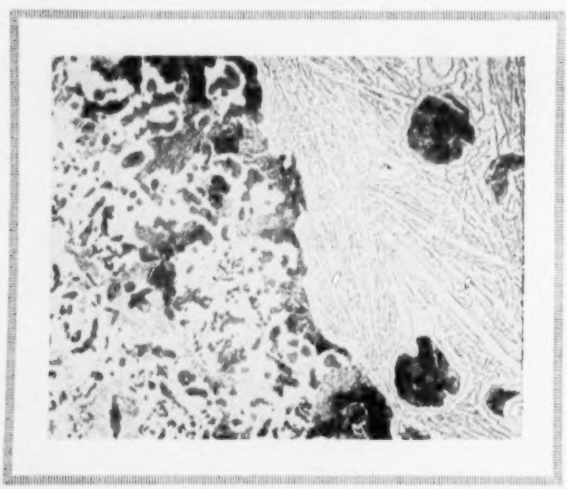


Fig. 4—Microstructure of zone between central and outer sections of high purity Fe-C alloy vacuum melted.

graphite was the stable form. The second observation was made by Morrogh and Williams,[2] and by Nipper,[3] who reported spherulites can be produced in iron-carbon alloys, vacuum-melted in graphite crucibles, using moderately fast cooling.

In the light of the above observations, it was decided to determine the graphite form in a high purity alloy melted in graphite under vacuum, and simultaneously observe the contact angle of the melt against the graphite. If graphite spherulites were to form in such a high purity melt, it would be an indication that perhaps it is the absence and not the presence of certain components that is responsible for spherulite formation. Even more important, knowledge of the contact angle would be of tremendous assistance in determining surface reactions at the various interfaces. The usefulness of such information is made apparent later.

Experimental Apparatus

A vacuum-fusion apparatus was built to melt high purity alloys in graphite crucibles with minimum chance for contamination under vacuo of the order 10^{-6} mm Hg. This apparatus is shown in Fig. 1.

The charge and crucible are heated by the high frequency field of an induction coil (A) surrounding the furnace chamber (B). Power is supplied by a 6kw induction unit (C).

The crucible assembly (D) comprises a graphite crucible (1/2 in. OD x 5/16 in. ID x 2 in. long) thermally insulated with fine graphite powder. The powder and crucible are contained in a silica tube 1 3/4 in. OD x 6 1/4 in. long, closed at the lower end.

Graphite was chosen as a crucible material because: (1) it was desired to measure the contact angle of the melt against graphite, (2) there is no chance for melt contamination by carbon reduction of the refractory as is the case in oxide crucibles, and (3) graphite of high purity could be obtained.

A high vacuum was used since the reaction $C + O = CO$ could be forced to the right by reducing the partial pressure of carbon monoxide, thereby lowering the oxygen dissolved in the melt to a very low value.

The vacuum system is all-glass construction, with one demountable joint (E). Access to the crucible assembly is gained through this joint which is sealed in place with Apiezon W (extremely low vapor pressure) wax. This joint and the furnace section are air-cooled with a blower (F).

The vacuum is produced by an all-glass, three-stage, self-fractionating oil diffusion pump (G) having an ultimate pressure at 25 C of 5×10^{-8} mm Hg and a speed of 25 liters per second at 10^{-4} mm Hg. This diffusion pump is backed by a mechanical pump having an ultimate vacuum of 5×10^{-3} mm Hg.

A liquid nitrogen trap (H) is provided between the vacuum furnace section (B) and the diffusion pump (G). This condenses any oil vapors from the diffusion pump and prevents their backing into the furnace section; this arrangement also prevents condensibles generated in the furnace section from traveling into the diffusion pump. The specimens are kept in side arms (J) and can be dropped into the crucible at any

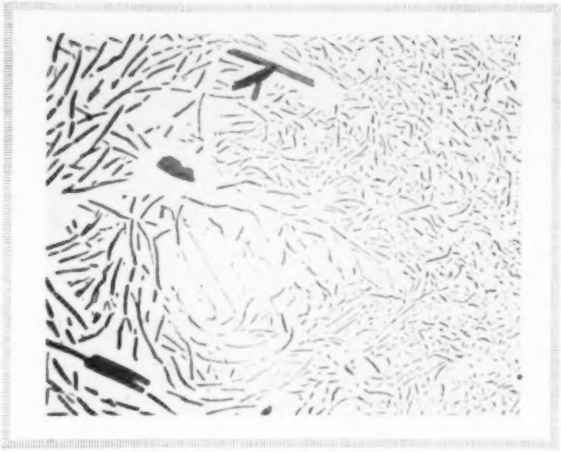


Fig. 5—Microstructure close to crucible wall of high purity Ni-C alloy melted under vacuum (X250 reduced ⅓).

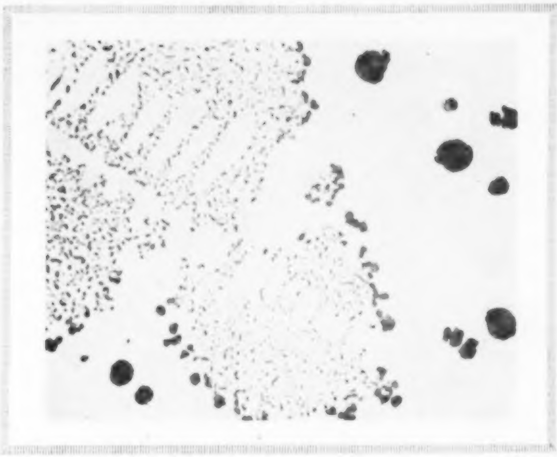


Fig. 6—Microstructure of zone between central and outer sections of high purity Ni-C alloy melted in vacuum.

convenient moment by using external magnets. Pressure is measured with a McLeod gage (K), a Thermocouple gage (L), and an Ionization gage (M). The mercury vapors from the McLeod gage are condensed by another liquid nitrogen trap (N) to prevent mercury contamination of the system.

High-Purity Materials Used

Graphite Crucible: Crucibles were machined from ½-in. electrodes having approximately one part per million impurity content (Spectrographic Grade).

Iron: High purity iron was obtained from the National Bureau of Standards, with less than 0.002 per cent metallic impurities and less than 0.01 per cent non-metallic impurities.

Silicon: High purity metal (above 99.99 per cent) was obtained.

Nickel: High purity nickel (above 99.99 per cent) was obtained.

Experimental Procedure

The empty crucible was heated three hours under vacuum (at 2200 C) to degas the graphite. After degassing, power was reduced and the crucible brought to operating temperature (about 1350 C).

About two grams of metal were then dropped into the crucible. As the carbon dissolved into the iron, large volumes of gas were evolved with subsequent increase in pressure. However, the pressure dropped steadily as the pumps evacuated the system. The melt was held at operating temperature for about three hours. The final pressure was 10^{-6} mm Hg, measured by an Ionization gage. The cooling rate in all cases was about one degree centigrade per second.

To date spherulitic structures have been observed in all melts. Spherulites of graphite were found in the central section of the ingots, associated with a predominately white iron microstructure. In all cases, this central section is surrounded by a ferritic rim containing finely dispersed graphite (similar to ASTM Type D) and large, chunky hypereutectic graphite.

Figure 2 shows the central structure of a melt made under vacuum using National Bureau of Standards iron in the crucible assembly previously described. About 0.8 per cent silicon was added to promote graphitization and so facilitate observation of the graphite form. The melt was saturated with carbon at 1350 C. Graphite spherulites, austentite dendrites, and a ledeburite structure are all present.

Figure 3 shows the surrounding rim with finely dispersed graphite, hypereutectic graphite, and a ferritic matrix. (All photomicrographs x 250 reduced ⅓.)

Figure 4 is the boundary of the central structure and the surrounding rim for a pure Fe-C alloy (no silicon added). The central section is predominately white iron; wherever graphite does appear it is definitely spherulitic and is associated with austenite dendrites. This microstructure in the ferritic rim for pure iron-carbon alloy is similar to that shown for the pure Fe-C-Si alloy in Fig. 3.

As Fig. 4 shows, the low graphitizing power of a pure iron-carbon alloy prevented complete observation of graphite form in the central section, since a large portion of the carbon appeared as cementite rather than as graphite. To circumvent this difficulty, a nickel-carbon system was next used.

The close analogy between the Ni-C and Fe-C systems has already been established and utilized effectively by Morrogh and Williams.[4] Since the carbide of nickel is far less stable than iron carbide, the form of the graphite could be more easily observed without the shrouding influence of a persistent metastable phase.

Wetting Characteristics

Two grams of nickel were melted under vacuum in the crucible assembly previously described. The microstructures of the surface, intermediate, and central sections are seen in Fig. 5, 6, and 7. The central section was completely spherulitic.

The solidified ingot of pure iron-carbon is shown in its crucible in Fig. 8. The definite, non-wetting contact angle of the melt against the graphite is obvious. This shows that vacuum melting a high purity iron in a graphite crucible has the same effect on the contact angle as does the addition of magnesium to cast iron.[1] A high contact angle is also observed in the case of the nickel-carbon alloy melted under the same condition.

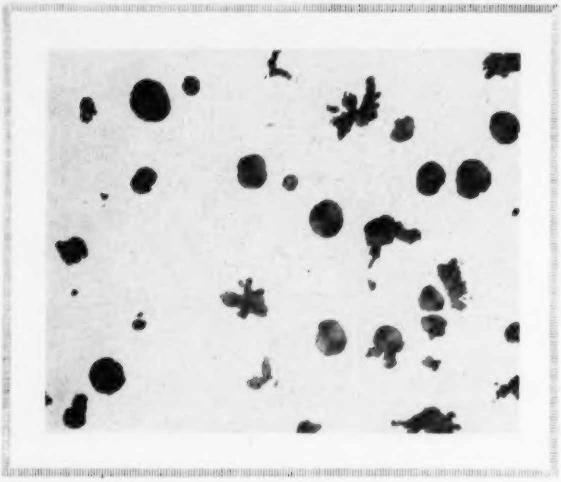


Fig. 7—Microstructure of central section of high purity Ni-C alloy melted under vacuum. (X 250)

Before discussing "contact-angle" further, some clarification of the phenomena may be in order. If a liquid drop and a solid surface are suspended independently in a gas phase, there is a definite energy per unit area at the liquid-gas interface called the free surface energy of the liquid (γ_{LG}). Similarly, there is a definite energy per unit area of the solid, called the free surface energy of the solid (γ_{SG}).

If the liquid is now brought into contact with the solid, a new interface is created, the liquid-solid interface. This also has a given energy per unit interfacial area called the free liquid-solid interfacial energy (γ_{LS}).

Once solid and liquid are in contact, the liquid will spread on the solid surface until its equilibrium configuration is reached. In this process of spreading, a part of the gas-solid interface is destroyed, being replaced by a liquid-solid interface. The energy which formerly was associated with the displaced solid-gas interface is given up to the system while energy is required to form the new liquid-solid interface. Energy is also required to extend the liquid-gas interface.

The drop therefore spreads to its equilibrium shape, which is that combination of surfaces which allows the system to have the least surface free energy. This equilibrium shape establishes the contact angle θ (Fig. 9).

The above surface energy concept can be more easily visualized in an equivalent form by employing the concept of surface tension. This involves replacement of the various surface energies by vectors originating from the point of contact of the gas, liquid, and solid phases as shown in Fig. 9. If a vector balance in the horizontal direction is made on the model, the equilibrium contact angle is given by Equation 1.

$$\gamma_{SG} = \gamma_{LG} \cos \theta + \gamma_{LS} \qquad (1)$$

It has been shown that the contact angle formed between a magnesium-treated iron, or a high-purity, vacuum-melted iron-carbon alloy against solid graphite is greater than the analogous contact angle of an untreated gray iron. Equation 1 shows the contact angle can be made greater by increasing γ_{LS}, increasing γ_{LG}, lowering γ_{GS}, or by combinations thereof.

The problem now becomes one of determining how the addition of magnesium or vacuum melting of high purity alloys can alter the interfacial energies. This may best be done by utilizing the concepts embodied in Gibb's Adsorption Theory. In simplified form, this is given by Equation 2.[5]

$$\frac{\partial \gamma}{\partial C_2} = - \frac{X_2}{C_2} RT \qquad (2)$$

where X_2 = the excess concentration above average of component 2 at the interface,

C_2 = the concentration of component 2 in the bulk liquid,

γ = interfacial energy (ergs/cm^2),

R = gas constant,

T = absolute temperature.

It is seen from Equation 2 that if there is a concentration of component 2 at an interface (i.e., X_2 is positive) when a small amount of component 2 is added to the bulk liquid, then there must be a decrease in the interfacial energy (i.e., $\partial\gamma$ is negative). The converse of this is equally true if there is a decrease in interfacial energy when a small amount of component 2 is added to the liquid, there must be a concentration of component 2 at the interface.

Equation 2 also predicts that slight increases in interfacial energy can be obtained by addition of component 2 to the liquid. This can arise by the negative adsorption of component 2 at the interface (i.e., a smaller concentration of component 2 at the interface than in the bulk concentration). This means X_2 will be negative and so $\partial\gamma$ will be positive, indicating the interfacial energy has increased.

If the average concentration of component 2 in the bulk liquid is small, the concentration of component 2 at the interface cannot decrease materially before it approaches zero. Therefore, X_2 will be a fairly small negative value and consequently $\partial\gamma$ a relatively small positive value. On the other hand, if positive adsorption takes place, the concentration of component 2 at the interface can actually approach 100 per cent, resulting in large positive values of X_2 and consequently large decrease sin interfacial energies. Since the effects sought are appreciably large, negative adsorption may be discounted as a possible mechanism.

Application of the Concepts of Surface Phenomena

It is now possible to analyze a theory proposed by Itaka:[6] the role of magnesium is to adsorb at the graphite-melt interface and increase its interfacial energy. This increase in interfacial energy causes graphite to assume a spherical shape similar to that of oil droplets in water. However, from Gibb's Equation, it is apparent a concentration at an interface can only lead to a decrease in interfacial energy.

It is also now possible to see why the contact angle of a magnesium-treated iron, and of a high-purity, vacuum-melted iron-carbon alloy against graphite, is greater than the analogous contact angle of an untreated gray iron. It is apparent that if surface-active elements were appreciably adsorbed at the graphite-melt and/or the melt-gas interface, the adsorption would lead to low interfacial energies as predicted by

Gibb's Adsorption Equation. These low interfacial energies in turn would lead to low contact angles as seen from Equation 1. If these surface-active elements were to be removed, then the interfacial energy could be greatly increased since it was the presence of these elements that caused its initially low value.

The effects of both magnesium and vacuum treatment upon the contact angle can be explained by assuming the above mechanism. The effect of vacuum fusion of the high purity alloy is to reduce the surface-active elements to an extremely low value, thereby producing a true graphite-melt and/or gas-melt interface and higher interfacial energies. The effect of magnesium and other spheroidizing elements is to form stable chemical compounds with these surface-active elements, thereby rendering them ineffective in lowering the interfacial energy. Both methods (vacuum melting or inoculation) lead to the same ultimate end—that of producing a true graphite-melt and/or gas-melt interface which has a higher interfacial energy than when the surface-active elements are adsorbed at the interfaces.

The contact angle can also increase by a decrease in the gas-solid interfacial energy, as seen from Equation 1. However, if this were an important effect one would expect a smaller contact angle for the vacuum-fused specimen than for the untreated iron, since vacuum treatment would tend to increase γ_{GS} by partial removal of any adsorbed layer. Since the opposite condition prevails, this effect is probably negligible and attention may be focused upon increases of the liquid-solid and/or gas-liquid interfacial energies. Of the two, it is more probable reactions taking place at the liquid-solid interface are more important since graphite is an excellent adsorbent.

In essence, this theory suggests there are surface-active elements adsorbed upon the graphite in untreated normal gray iron. Probably sulphur, and certainly oxygen, are important. Both oxygen and sulphur form stable compounds with magnesium and the other spheroidizing agents, thereby rendering them impotent as surface-active elements.

There is much evidence that oxygen is attracted to and strongly adsorbed upon graphite surfaces. Langmuir[7] found that after a graphite filament heated in vacuum was exposed to oxygen, such a strong surface adsorption of oxygen occurred that desorption could only be made to take place by heating the filament to 2200C, at which temperature the oxygen desorbed as carbon monoxide. The phenomena of oxygen adsorption is of great importance in the combustion of carbon and has therefore received considerable interest in the past. Most of the investigators in this field agree that oxygen forms a carbon-oxygen surface complex as an intermediate reaction during the combustion of carbon.[8,9,10,11,12,13]

Nucleation of Graphite

In comparing the cooling curves of a normal gray iron containing flake graphite versus the same alloy treated to cause the formation of spherulitic graphite, there is almost invariably an apparent lowering of the eutectic transformation temperature.[14,15,16] Analogous behavior is observed in the nickel-carbon and cobalt-carbon systems.[4]

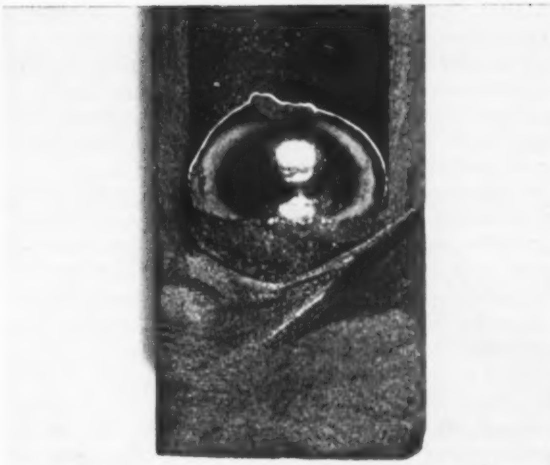


Fig. 8—Ingot shape of Fe-C alloy, in graphite crucible.

The fact that the eutectic temperature measured on heating corresponds to the equilibrium transformation temperature while the apparent eutectic temperature measured in cooling is lower, is a strong indication that the lower eutectic temperature in cooling is due to a difficulty in nucleation and is not an effect of magnesium upon the equilibrium transformation temperature.

These observations can be explained in the light of the information presented in this paper which suggest that surface-active elements exist in normal (gray) cast iron. The graphite-melt interfacial energy increases when these elements are eliminated. This elimination can take place either by addition of a spheroidizing element such as magnesium or cerium, or by the vacuum fusion of high purity alloys in graphite crucibles.

Undercooling Promotes Spherulites

Changes of the interfacial energy can have a pronounced effect on the nucleation rate of a phase[17] since this involves creation of new surface. One qualitative approach to nucleation theory is to consider the interfacial energy as a barrier to nucleation. The energy for creating a new interface is obtained by cooling below the equilibrium transformation temperature. The greater the degree of undercooling, the more energy is available for creating new surface.

If the graphite-melt interfacial energy were low (as in the case of normal flake gray iron), the barrier to nucleation is low and only a slight degree of undercooling is necessary before enough energy is available to create this new interface. For this reason, flake gray irons freeze close to the equilibrium transformation temperature. However, if the graphite-melt interfacial energy were high (as in the case of magnesium-treated or vacuum-melted irons), then there is a definite barrier to nucleation. In this case, a greater degree of undercooling is necessary before enough energy can be made available to create the graphite-melt interface.

The presence of dendrites of austenite and nickel solid solution (Figs. 2 and 6) in the central (spherulitic) section of the high-purity, vacuum-melted hyper-

eutectic alloys is strong evidence that undercooling is taking place in this central section.

DeSy attributes the observed undercooling in magnesium-treated irons to the magnesium reduction of silica or other nuclei which ordinarily nucleate flake graphite.[18] The absence of these nuclei then causes undercooling to take place.

A change in the form of the cooling curve, along with metallographic evidence, has led some investigators[16,19] to believe that spherulites nucleate and grow in supersaturated austenite. Similar evidence has led other investigators[14,15,20,21] to believe graphite spherulites nucleate in super-saturated liquid in close proximity to austenite dendrites.

Spherulitic Graphite Formation

From the argument above, the main role of the spheroidizing agent seems to be one of removing surface-active elements, thereby creating a high interfacial energy. This high interfacial energy then causes a high degree of undercooling to take place. Supersaturation follows as a consequence of this undercooling. It is then the growth of graphite in a supersaturated solution that seems to be a necessary requirement for spherulite growth.

Mehl[22] has pointed out that as the degree of supersaturation increases (i.e., as the degree of undercooling increases), the overall growth rate increases and the difference in the rate of growth among the different crystal faces decreases. This might well apply to this case since, in an iron precipitating spherulitic graphite, undercooling and supersaturation take place and the difference in the rate of growth in a direction perpendicular and parallel to the graphite basal plane has decreased. This tends to lead to spherical, rather than plate-like growth.

Another observation lending support to this theory is that fast cooling has been known to produce spherulites.[23,24] Of course, the greater the cooling rate, the greater will be the undercooling and consequent supersaturation. Cementite will ordinarily nucleate easiest under conditions of fast cooling. However, if conditions in the melt are conducive to the formation of a few graphite nuclei (i.e., very high carbon and/or silicon content leading to high graphitizing power of melt), then these nuclei will grow in a supersaturated melt leading to spherulitic growth.

Another possible consequence of this theory is an explanation of one type of carbide stabilization. As the barrier to the nucleation of graphite becomes higher (the graphite-melt interfacial energy increases), the greater will be the probability for cementite nucleation. For a given degree of undercooling below the equilibrium graphite-precipitation temperature, there is more energy available for graphite formation than is available for cementite formation since graphite is the thermodynamically stable phase. However, less energy is required to create a cementite-melt interface. Therefore, as the graphite-melt interfacial energy becomes higher, cementite will be able to nucleate more easily even though it is metastable. This can then explain why so much cementite is associated with the graphite spherulites in Figs. 2 and 4. This theory also explains why the spheroidizing elements are excellent carbide stabilizers since their addition to the melt results in increased interfacial energy.

The mechanism for graphitization is just the converse of that offered for carbide stabilization. If there is a high graphite-melt interfacial energy which enhances carbide nucleation as explained above, then addition of surface-active elements would lower the interfacial energy, thereby lowering the barrier to graphite nucleation. An excellent work in support of this was presented by Williams,[25] who shows the graphitizing power of small percentages of oxygen and sulphur.

Inverse Chill Explained

The outside rims of all the iron-carbon and iron-carbon-silicon ingots consist of ferrite and graphite, while the interior is white iron with some graphite spherulites. This is one type of inverse chill that can be explained in terms of the nucleating influence of the wall. In the above melts there is a high graphite-melt interfacial energy, and as previously explained, sufficient undercooling must occur to supply enough driving force to create the graphite-melt interface. However, at the wall of the graphite crucible, a graphite-melt interface is already present eliminating the necessity for undercooling. Since there is no difficulty in nucleating graphite, nucleation of cementite does not take place at this location. When solidification proceeds to such an extent that the nucleation effect of the wall is negligible, then the full effect of the

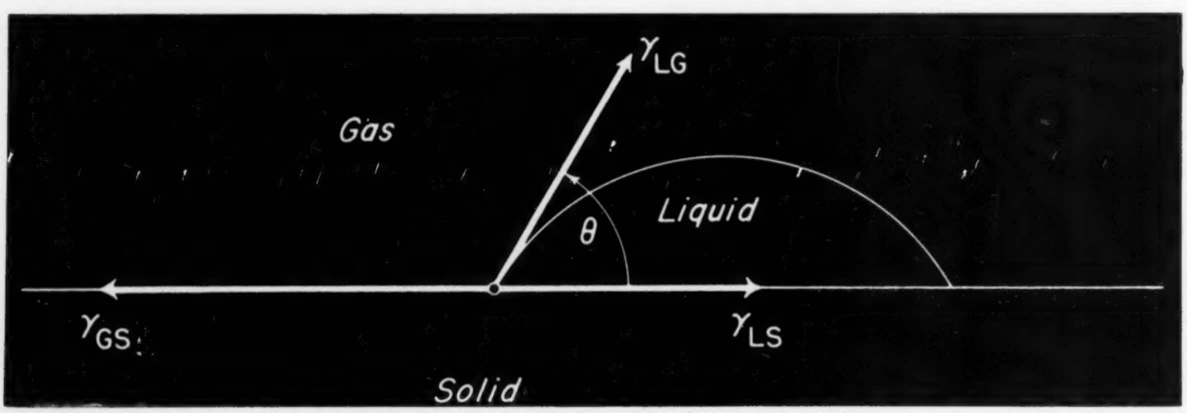


Fig. 9—Diagram of surface tension forces acting on a droplet.

high-interfacial energy prevails and spherulitic graphite and cementite formation proceeds according to the theory presented above.

This is an explanation for one type of inverse chill where the entire ingot would probably have solidified with a white iron structure if the effect of the graphite wall were absent. Perhaps other types of inverse chill incurred in practice can be explained either by this mechanism of direct nucleation effect of the mold wall, or by the pick-up of surface-active elements from the mold which would have a graphitizing effect in that metal closest to the wall.

ASTM Type D Graphite

The finely-divided graphite commonly called supercooled or ASTM Type D graphite was observed in both iron and nickel alloys. Figure 3 shows the undercooled graphite located between the central portion and the crucible walls in the iron-carbon-silicon alloy, while Figs. 5, 6, and 7 show best the changes in graphite form as one proceeds toward the center in the nickel-carbon alloy. This indicates that a degree of undercooling intermediate between that necessary for the formation of flake graphite and spherulitic graphite occurs for the formation of ASTM Type D (eutectiform).

Perhaps the effect of those substances which are capable of producing undercooled-type graphite (Ti and Zr, etc.) is similar to that of the spheroidizing elements differing only in degree.

Summing It Up

The contact angle of a commercial magnesium-treated cast iron and that of a high-purity, vacuum-melted iron-carbon alloy against graphite is greater than that of an untreated normal cast iron. Spherulitic graphite structures have been produced in the central section of high-purity, vacuum-melted iron-carbon, iron-carbon-silicon, and nickel-carbon alloys, with and without magnesium additions.

The difference in contact angles is interpreted as meaning that treatment with magnesium or melting "in vacuo" *desorb* the graphite-melt interface of surface-active elements, increasing its interfacial energy. This increase in interfacial energy presents a barrier to the nucleation of graphite causing undercooling to take place. Supersaturation is a consequence of undercooling. It therefore seems the formation of spherulitic graphite is due to its growth from a supersaturated medium. Cooling curve data taken by other investigators indicate that alloys containing spherulitic graphite have a greater tendency toward undercooling than normal gray irons. Formation of graphite spherulites in rapidly cooled irons can be similarly explained as growth in a supersaturated solution, since a fast cooling rate also increases undercooling and supersaturation.

The manner in which the graphite-melt interfacial energy affects carbide stabilization and graphitization is discussed. If the graphite-melt interfacial energy is high, then the barrier to graphite nucleation is high, and cementite will have a greater probability for nucleation. Conversely, if the graphite-melt interfacial energy is low, then the barrier to graphite nucleation is low and graphite can nucleate more easily. Since both magnesium and vacuum treatment act to increase the graphite-melt interfacial energy, this theory explains why magnesium treatment of cast iron and vacuum melting of high purity irons not only produce spherulites but often a large proportion of white iron.

Inverse chill was obtained in the high-purity, vacuum-melted iron-carbon alloys, wherein the outer rim contained flake graphite this is explained in terms of the nucleating effect of the graphite crucible walls. At this wall there is no difficulty in creating a graphite-melt interface, since one already exists. It is for this reason no undercooling takes place and the outer surface contains flake graphite. However, the full effect of the high graphite-melt interfacial energy is felt in the central portion of the melt. This causes undercooling and attendant supersaturation, resulting in the spherulitic growth of graphite. The high interfacial energy also results in a large amount of white iron.

The condition leading to the formation of ASTM Type D graphite seems to be intermediate between that leading to spherulitic and flake graphite.

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news of technical committees

Carbonaceous Material

On April 17 and 18, the Carbonaceous Committee of the Sand Division met at the Foundry Laboratory, Michigan State College, East Lansing, Mich. The session was presided over by W. R. Moggridge, Ford Motor Co.

Variations in raw materials and their effect on the characteristics of foundry sea-coal, were discussed. This new Committee has the responsibility of developing data on the behavior of various carbonaceous materials to determine the effect of composition, size, distribution, and origin on the operating characteristics of all carbonaceous materials in common use in the foundry.

The first foundry run of the Committee revealed some interesting relationships between coal size and shrinkage characteristics. It also helped to clarify both the problems to be studied and the research technique required for most rapid progress.

Committee on Safety

This Committee functions under the A.F.S. Safety & Hygiene & Air Pollution program. A meeting of the group was held on April 23 in Chicago, with Chairman John W. Young, International Harvester Co., presiding.

The mechanics of handling Safety meetings at the Convention were discussed in detail. The supervisors' training courses were discussed, together with recommendations as to the improvement of the material. It is hoped that they will be made available for general use through local A.F.S. Chapters by next fall.

The recent unfortunate Haber Corp. disaster in Chicago was discussed, as were other localized reports of industrial accidents. The material that has been prepared for use in the Recommended Good Safety Practices manual was reviewed by the Committee before adjournment.

Flowability Committee

The Sand Division's Flowability Committee met on May 8 in Chicago, under the chairmanship of J. B. Caine, Cincinnati, O. In order to minimize confusion, and only for committee discussions, definitions were adopted for two terms: flowability and rammability.

Investigations are planned by the Committee at William Kennedy & Sons Co., Owen Sound, Ont. The correlation between flowability and molding pressure will be explored at the Harry W. Dietert Co. The fundamentals affecting flowability will be a project at the University of Kentucky, under C. E. Wenninger.

G. J. Grott, Unitcast Corp., Toledo; and either H. H. Fairfield or James McConachie, Wm. Kennedy & Sons Co., were added to the Committee. Mr. C. E. Wenninger, National Engineering Co., Chicago, was appointed as the new Chairman with Mr. Caine retiring.

Brass & Bronze Division

The annual business meeting of this Division was held on May 5 in Chicago. Chairman B. N. Ames, New York Naval Shipyard, presided. Reports were presented by the Research, Program & Papers, Recommended Practices, Round Table Conference, Sand, and Nominating Committees.

Mr. Fred L. Riddell, H. Kramer & Co., Chicago, Chairman of the Research Committee, visited the University of Michigan with A.F.S. Technical Director S. C. Massari on March 31. They met with Prof. C. Upthegrove to discuss the production of a one-reel color film on procedure involved in making the "Fracture Test." Costs, story plot, and production procedures were examined.

Steel Division

Chairman Clyde B. Jenni, convened the Steel Division meeting in Chicago on May 7. Reports were received from Statistical Quality Control, Research, Round Table Conference, Program and Papers, and Nominating Committees.

A plea was made for more interest in the obtaining of papers from industry, which must balance the contributions of research institutions and technical schools.

Apprentice Contest Committee

Chairman R. W. Schroeder, University of Illinois, Navy Pier, Chicago, submitted suggestions to the Apprentice Contest Committee at its meeting on May 5 regarding a "new-man-in-industry" basis for conducting the Apprentice Contest. This method would replace the indentured apprentice basis. Experiences of the Birmingham Chapter in this respect were presented. Drawings for wood pattern, metal pattern, and molding divisions were submitted. They will be modified, reproduced, and circulated among committee members for further comment. These drawings will provide the basis for the 1954 Apprentice Contest.

The recently-formed Carbonaceous Committee of the Sand Division gathered at Michigan State College on April 17-18. Shown here, front (l. to r.): G. A. Kelly, Dominion Radiator; A. U. Carlson, Michigan State College; B. P. Wallace, Whitehead Bros. Co.; and F. S. Brewster, H. W. Dietert Co. Back row (l. to r.): Chairman W. R. Moggridge, Ford Motor Co. of Can.; C. A. Saunders, Acheson Colloids Co.; H. A. Stier, Whitehead Bros. Co.; T. E. Barlow, Eastern Clay Prods.; Wm. M. Peterson, M. A. Bell Co.; and C. C. Sigerfoos, Michigan State.

The BIG Story

Here are the Big Stories of five A.F.S. Chapters, high-lighting their major activities for 1952-53. Various phases of education, as related to the foundry, form the principal theme in these articles, in such fields as directly conducted courses, television programs, sound films, and round table conferences.

Chicago Chapter

Roy W. Schroeder
University of Illinois, Chicago

Following two successful years of conducting a school on various phases of foundry work, the Chicago Chapter's Educational and Lecture course committees combined to give foundrymen of this area an opportunity to discuss their gating and risering problems.

Realizing that the success of any undertaking lies in a solid foundation, committee meetings started immediately upon the close of last year's Melting School.

In line with the Chapter's educational policy, this year's "School of Gating and Risering" was designed to reach the men in the operating division of the industry, keeping the school on a level that in the past has proved to be best for the greatest number of participants.

Twelve Nights

The twelve operating nights of the school were divided equally among steel, gray iron, malleable and nonferrous. This division made it possible for men interested in more than one phase of the work to attend any or all of the lectures, and a number made use of that opportunity. Talks on "General Foundry Safety" were given to each group and Safety display boards with posters and equipment were displayed at each meeting.

Outstanding men in each phase of the work were picked as chairmen of particular groups, and these chairmen in turn picked committees to aid in formulating the group programs. Chairmen of the respective groups were: A. P. Di Girolamo, Steel, Chicago Steel Foundry; W. O. McFatridge, Gray Iron, International Harvester Research; K. P. Smith, Malleable, Chicago Malleable Iron Co.; and D. L. Colwell; Non-Ferrous, Apex Smelting.

Advertising

The committee designed its own poster and carried on its own advertising campaign. This consisted of announcements at all regular chapter meetings, mailing posters, letters and enrollment blanks to all who previously enrolled in a chapter school, all foundries within this area and chapters within a radius of 150 miles.

All meetings were held at the University of Illinois, Navy Pier Branch, Chicago. Facilities furnished by the university included lecture room, two microphones (one stand, one for panel), slide and movie projector, and other materials necessary for a successful school. Sincere thanks are due Dean Trezise of the Engineering College, through whose efforts this was made possible, and to the physical plant for its fine cooperation.

A nominal fee of $1.00 for the 12 meeting nights, or 50¢ for a single lecture, helped defray most of the expense. Chicago Chapter does not care to make money on its educational programs and has been most generous in giving financial aid to the Lecture Course and Educational Committees.

Steel Program

Two panel sessions were conducted by the steel group and one informal lecture and discussion with J. B. Caine, foundry consultant, as the lecturer and discussion leader. The panel sessions consisted of drawings of four castings supplied to each foundryman present. The panel then sketched on the blackboard the type of gating and risering that had proved successful in the production of castings—first by competent men specializing in light steel castings, then going to the medium weight and, finally, the gating and risering for heavy castings. Using this method, the students were able to sketch in the recommended procedure. Thus they could take some definite, successful practice back to their shops.

The second panel session followed the same procedure, using four different sketches.

The gray iron and malleable sessions followed the same patterns, with two

The Big Story

Many Chicago area foundrymen attended the gating and risering school.

informal lectures and discussions and one panel session. The third session in each case was a panel session comprising speakers at the first two sessions, as well as others.

The non-ferrous group listed as their subjects: Design, layout, gating and risering of pattern equipment; causes and corrections of casting defects by gating and risering; effect of gating design on casting quality. The third non-ferrous meeting made use of the A.F.S. color-sound movie on fluid flow.

★ The Big Story

Northwestern Pennsylvania Chapter

J. P. Finch
General Electric Co., Erie, Pa.

As a result of a lecture on the early foundry industry given by Earl Strick, Chairman of the Northwestern Pennsylvania Chapter Educational Committee, a local art studio owner, William Snyder, suggested the production of a visual presentation on the foundry industry. The result was a sound color slide film called, "Career in Metal," the preview of which was presented at the 1952 National American Foundrymen's Society Convention in Atlantic City.

After the many production recording and photographic problems were overcome, the film and record are now available for distribution.

The purpose of the program is to interest and inform the general public, and young men in particular, in the more than 300 occupations in the foundry industry. The cartoon style presentation has had wide and enthusiastic reception wherever it has been shown. We believe this to be the first youth encouragement endeavor of this type to be made by an American Foundrymen's Society local chapter.

The cost, distribution and production have been handled entirely by the local chapter. Our present task is to sell enough programs to local foundries for presentation to area school film libraries so that a copy will be available in every school. So far, three firms have made commitments and several more are pending.

Nationally, we hope to sell every chapter at least one copy for the schools of their area. So far Chicago, Syracuse, Michiana Chapter, Detroit, Saginaw, Montreal, Ontario Chapter, and Erie have at least one copy available for school vocational interest and guidance, all purchased by local A.F.S. chapters or members.

The film describes the possibilities for advantageous employment in engineering, metallurgical, molding, melting, finishing and service phases of the foundry industry by tracing the manufacture of a large jet engine casting through to its ultimate use in a jet plane. The script has been carefully prepared to avoid technical terminology and relate foundry processes to everyday operations. The program was not intended for technical audiences, but largely for young men in their junior and senior years in high school who are potential foundry employees.

Projection requires a 35 mm film strip projector and a 33⅓ rpm record player. This equipment is available in many schools or may be purchased through our local chapter. Further information can be obtained from Earl Strick, Chairman, Educational Committee, American Foundrymen's Society, Northwestern Pennsylvania Chapter; care of Erie Malleable Iron Company, Erie, Pennsylvania.

Our goal is to have every chapter purchase at least one program. Order one today—price only $100.00 and you can help future employment by showing our young men of America that "the Foundry *is* a good place to work".

★ The Big Story

Central Ohio Chapter

Douglas C. Williams
Ohio State University, Columbus

The Central Ohio Chapter is a member of the Columbus Technical Council which recently developed a series of television programs as part of the Council's efforts to inform the public about engineering. On November 18, 1951, the Central Ohio Chapter was responsible for the day's program on "Engineering Your Life," and for financing the telecast.

The Chapter appointed Hal Lawnie, Battelle Memorial Institute, then Chapter Reporter, to arrange all details with Richard Bell, the director of "Engineering Your Life." Lawnie and Bell worked out a program which took the foundry industry into the kitchen of the viewer's home. In looking around for the "live" part of the program, they finally persuaded Mr. Harry Sanders of Battelle Memorial Institute, and Dr. Douglas C. Williams of Ohio State University to take part.

The show opened inside the kitchen area of WBNS-TV, where there were familiar items, such as a sink strainer, a sink, water faucet, meat grinder, gas burner and venturi, and a sole plate from a household iron. A cast mold for making ice cream cones was shown and this was followed by presentation of the cast parts assembled into a drill press and a small electric motor. A cut-away view of an automobile manifold was shown for intricacy of design. Everyday items used by the public which were produced by rolling between cast rolls were glass plates and sheets, angle iron,

railroad rails, paper and metal foil.

The feature of the program was the making and pouring of a mold in the studio. The pattern used was for a book end and Wood's metal was poured. The procedure of mold making was explained in some detail. To complete this feature it was desired to shake out the mold to inspect the casting. Unfortunately, Wood's metal will not solidify fast enough before shake-out in the time available. While the TV cameras were busy with another part of the program, the mold that was poured was replaced with another mold which had been poured earlier and solidification was complete, and this mold was shaken out before the camera.

This program, and pictures of scenes, has appeared in the January 1952 issues of the AMERICAN FOUNDRYMAN and "Foundry."

The Cleveland Engineering Society and the Northeastern Ohio Chapter sponsored a casting program over WNBK on April 26, 1953 and Harry Sander and Dr. Williams again were the principals in this program.

Requests for copies of the foundry script section of the series, "Engineering Your Life," have been received from several parts of the United States. The Central Ohio Chapter is pleased to have sponsored this worthwhile effort to publicize the casting manufacturing industry and its engineering aspects.

★ The Big Story

Philadelphia Chapter

D. O. BEST
Bethlehem Steel Co.

THE "Big Story" in Philadelphia for '52-'53 is "Education."

For years, Philadelphia has been augmenting its Technical Program Series with short courses on sands, cupola operations, round table sessions and combination meetings with other technical societies, such as last year's course on non-destructive testing in conjunction with the Non-Destructive Testing Society, and this year's meeting with ASM.

Our educational committee, having noted the marked success of the brass and bronze round table luncheon meetings at our annual conventions, decided to follow the recent practice of using a prepared list of questions. As a result, last year's round table sessions on brass and bronze proved to be so worth-while that this year we ran concurrently the following round table sessions all from prepared groups of questions:

1. Brass and Bronze
2. Gray Iron
3. Steel

In this manner we are able to render far more service to our members and their foundries than has ever been possible with our regular monthly technical meetings.

Safety Conference

In 1952-53, as in the past several years, our chapter has sponsored the Foundries Sessions on Safety at the Philadelphia Regional Safety Conference. This phase of Education is an all-important one, demanding our utmost co-operation and attention.

Rounding out our Educational Program for this year will be the running of the new Dietert Sand Course on the 4th, 5th and 6th of June.

Always, our efforts are directed toward Education so we believe that the Philadelphia Story, The Philadelphia Chapter Big Story for "'52-'53," has been Education, covering many phases for the benefit of as many interests as possible.

★ The Big Story

Central Michigan Chapter

T. T. LLOYD
Albion Malleable Iron Co.

SOME sixty-eight members of American Foundrymen's Society Central Michigan Chapter attended a chapter sponsored metallurgical course in Battle Creek last winter. The course, designed to give operating foundrymen an insight into metallurgical fundamentals, was presented by instructors from three Michigan universities and metallurgists from industry within the chapter area.

In total, the instruction was equal to about 60 hours of collegiate work. The program, which consisted of eleven two-hour evening sessions at the Battle Creek High School, was broken into three parts: Metallurgical Fundamentals, Applied Fundamentals, and Ferrous and Non-ferrous Metals. The text used, the cost of which was included in the registration fee, was "Engineering Metals and Alloys," by Carl Samans.

Six-hour Course

The instructor for the first section was M. J. Sinnott, Associate Professor of Metallurgical Engineering, University of Michigan. In six hours, Mr. Sinnott covered the rather complex subject of basic metallurgy, including: structures, types, and relative properties of metallic crystals; polycrystalline materials; deformation, work hardening and recrystallization of metals; phases in alloy systems including pure metals, solid solutions, intermetallic compounds, and mixtures; the relation of time-temperature curves to phases; and the construction, significance, and interpretation of phase diagrams. A fourth session was devoted to a review by Frank B. Rote, manufacturing control manager, Albion Malleable Iron Company.

Richard A. Flinn, also an associate professor of metallurgical engineering at the University of Michigan, handled the first part of the second section, Applied Fundamentals. His subjects were solidification of metals, solidification defects, and the relationship between the latter and phase diagrams. The subjects covered such things as nucleation, grain growth, influence of cooling rates, the various types of porosity, and surface checks or hot tears.

Solid State Reactions

The second part of the second section was conducted by N. M. Lazar, Associate professor of Chemical Engineering, Metallurgical Department, Wayne University, Detroit. His first subject was reactions in the solid state which included recrystallization, quench hardening, precipitation hardening, and tempering. Professor Lazar's other subjects were the iron-carbon diagram and the T-T-T diagram for steels. The review session for the second section was conducted by Fitzmaurice Coghlin, Jr., Dock Foundry, Three Rivers, Mich.

The first part of the third section covered graphitization of gray iron during solidification and cooling, the annealing of malleable iron, and graphitization of ductile iron. The instructor for this session was Richard Schneidewind, professor of Metallurgical Engineering, University of Michigan.

The second part of the last section was presented by Dr. A. J. Smith, assistant department head, Mechanical Engineering, Michigan State College, East Lansing, and covered non-ferrous melting practices, the origin, detection, and correction of defects, and non-ferrous heat treatments. The review session for the last section was handled by Frank B. Rote and Fitzmaurice Couglin, Jr. In addition to Rote and Coghlin, C. C. Sigerfoos, associate professor of Mechanical Engineering, Michigan State College, acted as chairman for some of the sessions.

Arrangements for the course were made by Central Michigan's Educational Committee of which Jack Secor, Hill and Griffith Co., Niles, Michigan, was chairman. The cost of the course was $12.50 for members and $20.00 for non-members, including $8.00 for the textbooks.

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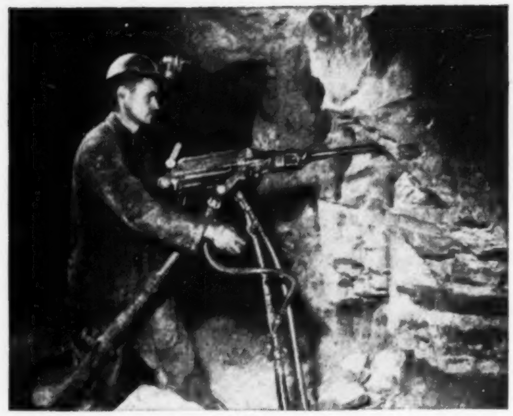

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Ferrovanadium (4 Grades)	Composition		
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In serious mood at April meeting of St. Louis District Chapter, is John A. Mescher, Unitcast Corp., Toledo, Ohio, who presented talk on core blowing developments.

Chapter News

★ Over the Top

As of May 22, 1953, active membership in American Foundrymen's Society totalled 11,087, achieving the goal for 1953!

Much of the credit goes to the vigorous work of chapter workers for their efforts during the first half of the year. Five new chapters hit their targets in April, and three dropped back from their targets that were reached in March. The new chapters are: Central Indiana, Mo-Kan, St. Louis, Southern California, and Western Michigan. Northern California, Texas and Timerline hit their March targets but dropped back in April.

All chapter committee men and membership workers are to be congratulated for their part in aiding A.F.S. to reach its 1953 goal by midyear. It is imperative that the effort be continued at maximum, however, in order to preserve the gain. Let's keep up the good work!

Eastern New York

A. J. Kiesler

General Electric Co.

The third Tuesday of April, saw the Eastern New York Chapter sponsor a plant visitation in the afternoon and meeting on sand control in the evening.

Some twenty foundrymen were able to attend a chapter sponsored visit through the plant of Adirondack Foundries and Steel Corporation. As guests of Plant Manager Cliff Apgar, Chief Metallurgist Chet Richards and Metallurgist and Chairman of the Eastern N. Y. Chapter Leigh Townley, the foundrymen toured the entire facilities of Adirondack. Primarily their interest lay in the operations of the steel foundry. However, demonstrations were put on by members of the laboratory showing how quality is controlled by means of tensile and impact tests.

Also present for the tour was Frank Brewster of the Harry W. Dietert Company, Detroit, Michigan. Mr. Brewster was principal speaker of the evening. His subject was "The Why and How of Sand Control." Over 60 foundrymen listened attentively while Mr. Brewster outlined the means by which sands can be controlled in a foundry whether it be a large or small operation.

(Eastern New York Chapter Officers for 1953-54:

Chairman: Edwin S. Lawrence, *General Electric Co.*, Schenectady, N.Y.

Program Chairman: William C. Stevenson, *Rensselaer Valve Co.*, Troy, N. Y.

Northwestern Pennsylvania

Roy A. Loder

Erie Malleable Iron Co.

The Northwestern Pennsylvania Chapter of the American Foundrymen's Society held its regular meeting April 27th in the Blue Room of the Erie Moose Club. A large number of members and guests gathered from far and near to hear the speaker of the evening, Tom E. Barlow, sales manager of the Eastern Clay Products Department of the International Minerals & Chemical Corporation.

A very enjoyable cocktail hour was had before dinner.

Fred J. S. Carlson, Weil-McClain Company, chapter chairman discussed the Chicago Convention trip. He then called on the Nominating Committee for their report after which the meeting was turned over to our program chairman, Charles F. Gottschalk of the Cascade Foundry who introduced the speaker of the evening.

Mr. Barlow gave one of the most interesting talks on "Casting Defects In Relation To Sand Practice" that has been given before our chapter, pointing out that sand caused more defects than all other causes put together.

There was a very interesting question and answer period following the regular talk which could have run into the wee hours of the night had not closing time interfered. All of those present voted this one of the best meetings of the year.

Ohio State

Ronald C. Martin

The Ohio State Student Chapter of A.F.S. held this month's meeting on April 7, at which a movie on shell molding processes was shown. F. R. Schultz, formerly consultant engineer and now with Material Handling Systems Inc., Detroit, then discussed shell molding machines and related materials handling problems. The guest speaker for the May 12 meeting was Stewart Crawford, an O.S.U. student, who spoke on X-ray procedures and radiology as applied to aluminum castings.

On April 22, a number of chapter members were guests of the Malleable Founders Society at an informal dinner meeting in the Ohio Union. The general theme "Opportunities in the Foundry Industry" was discussed.

Saginaw Valley

Roy S. Dahmer

Eaton Manufacturing Co.

"Milestones in the Progress of Cast Iron Metallurgy" was the subject of an address by J. S. Vanick, International Nickel Company, at the April meeting of the Saginaw Valley Chapter in Frankenmuth.

Mr. Vanick described and presented slides of some early furnaces built in this country, the first ones being square in design. Early developments were made in fuels for melting, charcoal being used originally as a fuel with anthracite coal, bituminous coal, and coke following later. Most of the time was spent in getting the iron out of the furnaces with apparently very little thought of metallurgy.

It was indicated that the practice of remelting in a cupola started about 1750, coke being developed at about

Wisconsin Chapter's Old-Timers Committee chairman Charles Zahn (left), Vilter Mfg. Co., presents Old-Timers plaque to President-Elect A. F. Pfeiffer, Allis-Chalmers Mfg. Co., who accepts in the spirit of joviality that marked the occasion.

Chapter News

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the same time. Over one hundred years elapsed, however, until furnace operators began to seriously consider metallurgy, physical properties, and methods of testing iron.

The speaker turned to present day practices and presented slides showing a practical base chart of charge materials for operating metallurgists; effect of alloys on tensile strength, hardness, and chill depth; ductile cast iron; and the relationship between elongation, tensile strength, and hardness of as cast and ductile irons.

Mr. Vanick concluded by stating that future developments in metallurgy will emphasize shape, size, and distribution of graphite in iron.

Chapter Chairman Kenneth H. Priestley served as technical chairman and introduced the speaker.

Saginaw Valley Chapter officers for 1953-54 are:

Chairman: F. James McDonald, *Central Foundry Div., G.M.C.*, Saginaw, Mich.

Vice-Chairman: Woodrow Holden, *Foundry Div., Eaton Mfg. Co.*, Vassar, Mich.

Secretary: Fred P. Strieter, *Die Casting Dept., Dow Chemical Co.*, Midland, Mich.

Treasurer: Lenwell A. Cline, *Saginaw Foundries Co.*, Saginaw, Mich.

Detroit Chapter

WALTER P. KANTZLER
Kelsey-Hayes Wheel Co.

The Detroit Chapter sponsored a plant visitation trip to the Ford Cleveland Foundry on April 17, 1953. The chartered bus trip originated at the Ford Motor Co. Rouge Plant, with 155 members of the Detroit Chapter. They were joined enroute by 28 members of the Toledo Chapter.

On arrival at the plant, the group was conducted on an inspection tour. The core room, melting, molding, cleaning, and allied facilities were thoroughly covered by the group. An excellent dinner was then served in the company cafeteria after which Claude Jeter, general manager, gave a short talk on the foundry itself, and then introduced the management staff.

The group then boarded the buses for the return trip to Detroit.

(Detroit Chapter Officers for 1953-54:

Chairman: Harry E. Gravlin, Jr., *Ford Motor Co.*, Dearborn, Mich.

Vice-Chairman: Claude B. Schneible, *Schneible Co.*, Detroit

Secretary: Elmer W. Gerhard, Jr., *Swedish Crucible Steel Co.*, Detroit

Treasurer: Eugene J. Passman, *Frederic B. Stevens, Inc.*, Detroit)

Central Illinois

L. E. KINSINGER
Caterpillar Tractor Co.

"I'm not afraid of the few communists in U. S. industry. I fear the millions of honest American workers who have real doubts whether they're getting a fair shake from the free enterprise system."

That was Ben H. Taylor's thought when he addressed the Central Illinois Chapter, American Foundrymen's Society, May 4, 1953 at the American Legion Hall, Peoria, Illinois.

Taylor is industrial relations manager of B. F. Goodrich Co., Akron, Ohio, and spoke on "Today's Challenge in Human Relations."

"In the next 50 years," Taylor said, "America will decide whether free enterprise is to continue here." The real tragedy of our large American plants —which have raised our standard of living to the world's highest—is that many workers have never learned how important their individual jobs are. Free enterprise has fallen down on its public relations. People don't know the good things it has done for us all."

"You can buy an employee's time, physical presence and skill but you cannot buy his enthusiasm or loyalty. Enthusiasm and loyalty must be earned. They can be earned by giving workers a sense of pride in their job. Show them they are vital to the final product."

He defined American industry's meanest man as the foreman "who ig-

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Erie's Moose Club was the scene of the April meeting of Northeast Pennsylvania Chapter. Group shown are some who heard Tom Barlow, Eastern Clay, speak.

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nores people because he's weighed down with his own importance. We need bosses who are genuinely interested in the folks under them."

He said "Men lose faith in themselves if they are forced to operate under policies that they feel are unfair and we should always use the maxim of telling people why they are doing things and explain regulations and policies."

Cliff Hathway, assistant labor relations manager, Caterpillar Tractor Co. was technical chairman for the evening and said "The size of the group indicates the awareness of the importance of human relations that is necessary to continue the progress of our American standard of living."

Henry Felten, plant manager, Peoria Malleable Casting Co., was elected '53 Chairman and Burton Bevis, supervisor, Education and Training Dept., Caterpillar Tractor Co. was named Vice-Chairman. J. Hrvatin, Staff Engineer, Caterpillar Tractor Co. was elected Secretary-Treasurer.

New Directors are George Rockwell ('52 Chairman), supt. foundry planning, Caterpillar Tractor Co., Gilbert Lloyd, office manager, Brass Foundry Co., and Robert Paluska, owner of Precision Patterns, all of Peoria, Ill.

Shown at Eastern New York's April gathering: from left: Charles Bryk, Eddy Valve Co.; Henry Wheeler, Wheeler Bros. Brass Foundry; Don Wheeler, Wheeler Bros.; Leo Scully, Scully Fdry. & Mach. Co.; and Jos. Wheeler, Wheeler Bros.

This view of the speakers table at April meeting of Saginaw Valley Chapter shows (l. to r.): Secretary Woodrow W. Holden, Eaton Mfg. Co.; Albert E. Edwards, Chevrolet Gray Iron Div., GMC; Speaker J. S. Vanick, International Nickel Co.; Chairman Kenneth H. Priestley, Vassar Electroloy Prods.; Vice-Chairman F. James McDonald, Central Fdry Div., GMC; Arthur H. Karpicke, GMC; Fred P. Strieter, Dow Chemical Co.; and Carl F. Wood, Chevrolet Div., GMC.

Metropolitan Chapter

ROBERT J. ELY
American Brake Shoe Co.

"Detection and subsequent evaluation of defects are the two inseparable phases of non-destructive testing," Clyde B. Jenni, chief metallurgist, General Steel Castings Corp., Eddystone, Pa., stated at the April meeting of the Metropolitan Chapter A.F.S. held on April 6 at the Hotel Essex in Newark.

The detection of defects and arbitrary scrapping of parts is not the aim or purpose of the various methods available for non-destructive testing. Whatever the testing method or tool used, they merely provide the inspector with information which he must then use to determine whether the part in question can perform its intended service. Mr. Jenni cautioned against the possibility of rendering a part less serviceable by attempting repairs than if no salvage effort were made.

As an example of this, he mentioned the always existant possibility of replacing a round smooth gas type defect, often harmless, with sharp crack type defects during welding operations.

Mr. Jenni's talk covered principles and practices involved in radiography, including low voltage x-ray, gamma ray, and high voltage betatron methods. In addition, he spoke of the use of ultrasonics, dye penetrants, magnetic methods, as well as the strain gage techniques, pointing out the advantages and limitations of each.

He further emphasized the importance of non-destructive testing methods not only in evaluating current designs but in developing improved designs.

Mr. Jenni's talk was accompanied by a presentation of several very interesting slides.

Technical chairman was B. N. Ames, senior metallurgist, Material Laboratory, New York Naval Shipyard.

St. Louis District

FRED J. BOENEKER
Bronze Alloys Co.

Some 125 members and their guests enjoyed the refreshment hour and dinner preceding the April meeting of the St. Louis District Chapter. Chairman Henry W. Meyer, General Steel Castings Corp., introduced the "Coffee Talk" speaker, Robert Wolf, Missouri School of Mines & Metallurgy, Rolla, Mo., who presented a color motion picture film showing processes employed in the school's educational foundry in teaching students the art of making castings and the basic fundamentals of the foundry as a trade. Mr. Wolf thanked St. Louis District Chapter members and the F.E.F. for their

Chapter News

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excellent support toward the school's foundry program.

Membership Chairman Walter A. Zeis, Walter A. Zeis Foundry Supplies & Equipment Co., reported that the membership goal set for the St. Louis Chapter had been reached. Mr. Zeis and his hard-working committee were given enthusiastic applause.

Principal speaker of the evening was John A. Mescher, core supervisor, Unitcast Corp., Toledo, Ohio, whose topic was "Latest Developments in Core Blowing." After giving a resume of the fundamental principles of core blowing, Mr. Mescher explained the relative advantages of various types of core blowing machines which were shown on the screen. The speaker pointed out the need of proper sand, core box design and placement of blow holes and screens, so as to produce maximum core quality at lowest cost. An unusual feature of the meeting was the reintroduction of the speaker by John Shive, Sterling Steel Casting Co., East St. Louis, who was acting as technical chairman, in order that Mr. Mescher could present an added talk entitled "The Nature of the Enemy," in which he outlined the fundamental principles of Communism and how these principles are diametrically opposed to Democracy and Christian Civilization. Mr. Mescher urged St. Louis foundrymen to strive for more and more productivity as an effective means of making Democracy strong and protecting the free enterprise system.

St. Louis District Chapter has elected its officers for 1953-54:

Chairman: Webb L. Kammerer, *Midvale Mining & Mfg. Co.*, St. Louis.

Vice-Chairman: Fred J. Boeneker, *Bronze Alloys Co.*, Webster, Mo.

Secretary: Paul E. Retzlaff, *Nordberg Mfg. Co. Div., Busch Sulzer Bros. Diesel Eng. Co.*, St. Louis.

Treasurer: John H. Culling, *Carondelet Foundry Co.*, St. Louis.

Tennessee Chapter

PORTER WARNER, JR.
Porter Warner Industries

The regular dinner meeting of the chapter was held on April 24th with 75 guests and members present.

The speaker was S. C. Massari, technical director of A.F.S., whose subject was "Effect of Gating Design on Casting Quality."

The nominating committee presented a slate of officers for the new year: Will Delaney, Eureka Foundry

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Birmingham Chapter's Apprentice Contest Winners (l. to r.): J. L. Cummings, A. O. Eidson, M. C. Stephens, Sinclair Lathern, and V. L. Bradford.

Frank Brewster, H. W. Dietert Co., picks winning ticket from basket held by Eastern New York Chapter Chairman Leigh Townley. Looking on (l. to r.): Jack Waugh, General Electric; Ed Lawrence, Chapter Vice-Chairman, General Electric; and Ken Mason, Albany Castings Co., who is also a director of the Chapter.

Speaker's table at Eastern New York's March meeting (l. to r.): Bill Stevenson, Rensselaer Valve Co.; Bill De Vries; Al Hawn, Ravena Iron Works; Jack Davidson, General Electric; Mrs. Connie Shaver, Allegheny-Ludlum Co.; Ed Lawrence, General Electric; Richard Herold, Borden Co.; Stanley B. Terhune, Watervliet Arsenal; Warren Savage; and Leigh Townley, Adirondack Foundries & Steel Co.

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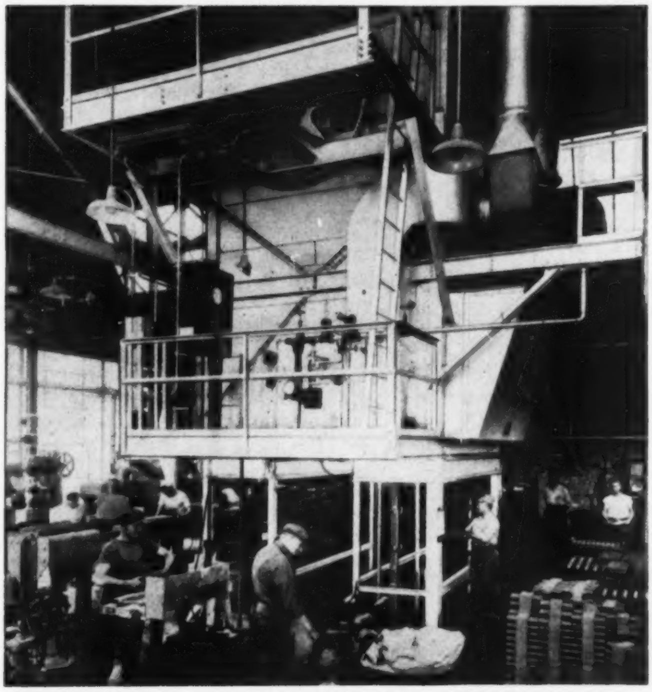
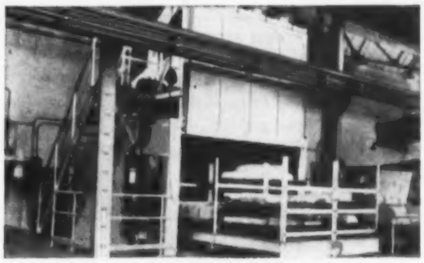


Coleman Tower Oven at Wells Manufacturing Co.



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■ **A289 . . "An Automatic Molding Machine," R. Orban, *Gjuteriet*, vol. 42, no. 12, December 1952, pp. 199-202 (in Swedish).**

An apparatus of Swedish construction is described which automatically controls the successive operations in the usual squeezer-type molding machine. Unlike all other existing apparatus serving the same purpose, in which electronic or purely mechanical devices are used, the new arrangement comprises pneumatic controls only. Once started by remote control, the machine automatically performs the successive operations of jolting, squeezing, vibrating, etc., the duration of each operation being previously set according to the shape and size of the pattern and the quality of the sand. The principle involved is such as to permit various extensions of automatic procedures so as to include filling of the box with sand, etc.

■ **A290 . . "Centrifugally Cast Steel Tubing," T. E. Rybka, *Materials and Methods*, vol. 37, no. 2, February 1953, pp. 104-107.**

Centrifugally cast steel tubing is a relatively new product that is ideally suited for the production of many high-quality engineering parts. The centrifugally cast product is superior in its ductility and its freedom from unsoundness, such as porosity, subsurface seams and inclusions; it is practically free from segregation; and it can be produced to closer tolerances. Moreover, as compared to rolled steel, centrifugally cast steel does not show directional properties.

Steel tubing produced in this manner finds extensive applications in replacing parts formerly made by forging. Numerous typical applications are described and illustrated. Results of tests indicating the exceptionally good properties of centrifugally cast steel tubing are tabulated.

■ **A291 . . "An Arc Furnace for Melting Refractory Metals." J. W. Pugh, R. L. Handley and R. W. Kenning, *Metal Progress*, vol. 63, no. 3, March 1953, pp. 70-71.**

An arc furnace employing an inert atmosphere and a water-cooled metal crucible is being built by General Electric for consolidating refractory metals and alloys, including titanium, zirconium, and chromium. The 7-ft tall furnace consists of an upper and lower shell, a water-cooled tungsten electrode, two vibratory feeders and supply hoppers, a water-cooled crucible or melting tube, and an ingot extraction rod and drive mechanism. A photograph and several diagrams are shown.

■ **A292 . . "Pinholing and Boiling in Enamelled Light-Iron Castings," E. Holland, *Foundry Trade Journal*, vol. 94, no. 1905, March 5, 1953.**

The factors which cause pinholes in normally-perfect castings and blisters (or boils) after enamelling were studied through a trial-and-error approach. Conclusions regarding pinholing are that steady pouring with minimum agitation, hot metal, and smooth-flowing runners are essential. Boiling, the author feels, is caused by something of the nature of ferrous sulphide formed on the surface of castings between 950 and 850 C by soot containing ammonium sulphate and ammonium chloride. Soot forms on the sand grains as smoke from partially-burnt coal-dust used in the facing.

■ **A-293 . . "Which Gray Irons for Large Volume Production?" E. A. Loria, *Iron Age*, vol. 171, no. 15, April 1953, pp. 131-133.**

Machinability results on alloy cast irons have produced dependable data on the most widely used irons. In cast iron, phosphorus combines with iron to form steadite, containing about 10 per cent P; a phosphorus content of 0.50 per cent indicates a steadite content of about 5 per cent. Tool-wear tests for the high-phosphorus gray irons show that these irons are quite machinable and compare very favorably with similar tests on low-phosphorus irons. This lack of adverse effect on machinability shown by steadite is attributed to the fact that steadite is the lowest melting constituent present in cast iron, so that the high temperature at the tool edge is sufficient to soften it.

Safety Device for Jolt-Squeeze Machine

In mold-squeezing operations where a head is swung over mold and mold is pushed up to squeeze sand to desired hardness, it is very important for workmen to keep hands in the clear. This is made certain by having four push-buttons that must be activated manually by two operators, employing all four hands, as illustrated above. Only two buttons are used on one-man machine. (Reported by Tom Butler, Ford Motor Co., Dearborn, Mich.)

Foundry Tradenews

Erie Foundry Co., Erie, Pa., have created a mechanical-engineering, scholarship fund at Fenn College. The fund, known as the Erie Foundry Foundation Scholarship, will go to a high school graduate of the Erie area. The student agrees to fulfill his co-operative work requirements as an employee of the Erie Foundry Co. for one quarter of the year. D. Angus Currie, chairman-treasurer of Erie Co., stated that the scholarship will be awarded on the basis of secondary school credits, aptitude and citizenship. It carries a stipend of $1,200 for the freshman year and $450 for each upper class year of the five year course, and is to be renewed annually upon completion of satisfactory scholarship and cooperative employment record.

The **Pittsburgh Lectromelt Furnace Corp.** has been exclusively licensed in the United States to produce high frequency induction furnaces developed by Allmanna Svenska Electriska Aktiebolaget, Vasteras, Sweden. The licensing makes Lectromelt the second manufacturer of this type of melting furnaces in America. According to Lectromelt's president, William Wallis, the addition to its line is in keeping with the firm's policy of offering a complete line of such apparatus. Lectromelt is cataloging the induction furnaces in 11 sizes with nominal charge capacities from 500 to 15 tons.

American Brake Shoe Co., New York will begin work shortly on a plant in Alabama for the manufacture of a new cast steel freight car wheel. The plant will be completed in 1954 at a cost of approximately $3,000,000. The new wheel is the result of 12 years of laboratory research. It has been in field-test in all types of freight service for five years.

Pekay Machine & Engineering Co., Chicago, has acquired the entire machine shop and production facilities of **Pekay Metal Fabricators.** The completely integrated and controlled manufacturing set-up which this gives the company is expected to result in substantially faster and better production on the whole Pekay line.

George Sall Metals Co., Inc., opened a plant in Philadelphia May 27 for the manufacture of non-ferrous metal ingots from scrap materials. The 73,000 sq ft building of brick and steel is completely fireproof and employs almost every known modern device for scientifically controlled output.

Eutectic Welding Alloys Corp., Flushing, N. Y., has established an Eastern Division at 1060 Broad St., Newark, N. J.

Thor Power Tool Co., Aurora, Ill., has moved its Buffalo, N. Y. branch office into a new building at 735 Military Rd., Buffalo. The new office will be under the direction of C. T. Connoly.

Magnaflux Corp., pioneers in the field of testing since 1929, extended an open invitation recently to visit their new plant at 7500 Lawrence Ave., Chicago. The new plant and main office

building, nearly twice the size of the old plant, and the nine-acre site provide room for future growth. Over one-third of its over-all space has been devoted to research and special engineering facilities.

Carl E. Rowe & Co. moved to larger quarters at 500 W. National Ave., Milwaukee, May 1. The company has reorganized and is expanding its staff in the fields of mechanical and electrical engineering, technical foundry, and management engineering.

Cleco Div., Reed Roller Bit Co., Houston, Texas, has appointed F. C. Bishop Co., Inc., Buffalo; Flood & Calvert, Inc., Galveston; and Paterson Machinery Co., Nashville, Tenn.; distributors for Cleco products in their areas.

United Compound Co., recently moved into their specially designed factory at 611 Indian Church Rd., Buffalo. In addition to its known brand of vent wax, the company plans to manufacture a new type, all-weather vent wax.

Troy Belting and Supply Company, Inc., Troy, N. Y. has been appointed distributor in eastern New York and western Vermont for continuous-cast bronze products of **American Smelting & Refining Co.,** Perth Amboy, Barber, N. J.

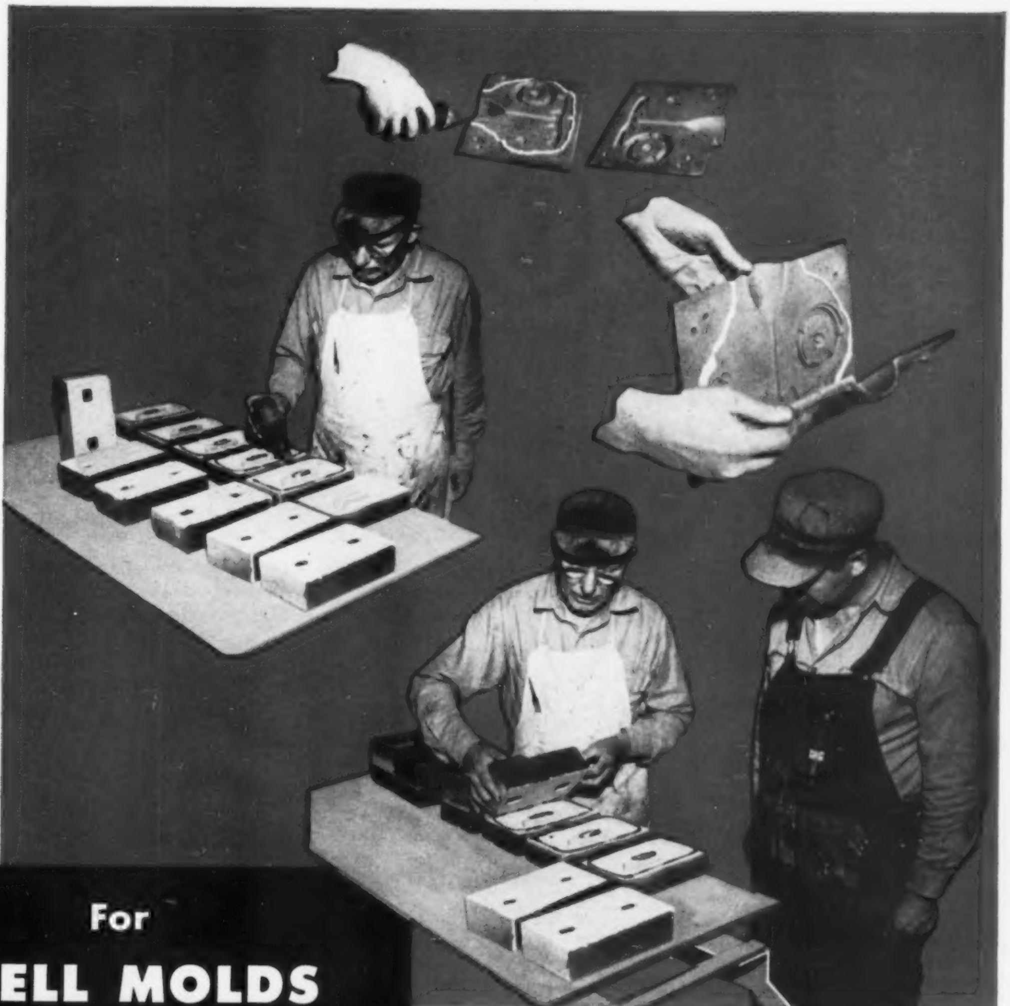
Pangborn Corp., has completed an addition to its Hagerstown, Md., production facilities. The building has been designed with adequate headroom for the production of new, taller, automatic blast cleaning equipment. One 5-ton and one 10-ton crane have been installed to facilitate materials handling in the production area. The importance of materials handling is indicated by the expenditure of $50,000 for truck loading docks out of the total $300,000 cost of the building.

Reynolds Metals Co. will alter plant 9 in Louisville, Ky., to enable the plant to handle all steps in the production of aluminum foil. The alteration program calls for modernization of the cast house where pig aluminum is melted and cast into billets for rolling. New ovens, and new "hot lines" for rolling to thinner gauges will be installed.

Construction of a refractory specialties plant at Janesville, Wis., having a capacity of 75,000 tons a year was begun May 1 by **Industrial Minerals Div.,** International Minerals & Chemical Corp. Chief product of the new plant will be a granular refractory for air application in the patching of metal melting furnaces.

Raybestos-Manhattan, Inc., Chicago, has moved from 445 Lake Shore Dr. into its newly constructed Chicago office and warehouse building at 6010 Northwest Hwy. This new building provides greatly expanded facilities for the Chicago sales offices, warehousing of products, and national sales headquarters for the Equipment Sales Div.

The first investment casting plant in the Pacific Northwest has been established by **Precision Castparts Corp.** The plant, which is located in Portland, Ore., will produce intricate small parts from both ferrous and non-ferrous metals. Precision Castparts has been set up as a pilot plant and subsidiary of **Oregon Saw Chain Corp.,** Portland, Ore.



Chapter News

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Company, **Chairman,** Charles Chisholm, Wheland Co., **Vice-Chairman,** Carl A. Fischer, Jr., Fischer Supply Company, **Secretary-Treas.;** Directors one year: W. M. Hamilton of Crane Company, James B. Mullinex of Foundries Supply Company; Directors for three years: Tink A. Johnson, Sommerville Iron Works, Roy H. Baker, Lenoir Car Works, Lenoir City, Tenn.

These nominees have been elected and will serve during 1953-54.

Ben H. Taylor, B. F. Goodrich Co. (center), was the speaker at the May meeting of Central Illinois Chapter. He is shown with: Cliff Hathaway, technical chairman, Caterpillar Tractor Co. (left), and John Hrvatin, Caterpillar.

Chesapeake

Joseph O. Danko, Jr.
Wabash Mfg. Co., Inc.

The regular March meeting of the Chesapeake Chapter was held on Friday, March 27, with dinner at the Engineers Club in Baltimore. The highlight of the evening was a discussion on nodular iron by Richard P. Dunphy of the Naval Research Laboratories, Washington, D. C.

Nodular iron Mr. Dunphy explained, does not fit all applications. More harm than good would be done to this material if it were to fail in a design where it does not belong.

In nodular iron, the energy, charpy, fatigue and ductility transition curves behave in a similar manner with a change in temperature. Chills may form hard spots, but in general nodular iron machines as good as or even better than cast iron.

Melting presents a few problems among which are the need of inert gases to keep the magnesium additions from oxidizing in the ladle, Mr. Dunphy explained.

Chesapeake Chapters Officers for 1953-54:

Chairman: William H. Baer, *Navy Dept.,* Washington

Vice-Chairman: Michael J. Kelly, *Kelco Corp.,* Baltimore

Secretary: Lewis H. Gross, *Amer. Rad. & Stand. San. Corp.,* Baltimore

Treasurer: William O. Becker, *Atlantic Abrasive Co.,* Towson, Md.

Notes about core blowing are being compared at the April meeting of St. Louis District Chapter. From left: Technical Chairman John O. Shive, Sterling Steel Casting Co.; John Mescher, Unitcast Corp., Toledo, O., principal speaker; and Chapter Chairman Henry W. Meyer, General Steel Castings Corp.

Birmingham

J. P. McClendon
Stockham Valve & Fitting Co.

Birmingham foundrymen devoted an entire evening to presenting prizes, looking at contest patterns and castings and hearing comments from the contest judges.

The symposium was presided over by Tom H. Benners, Jr., chairman of the Education Committee.

V. I. Byford, superintendent of production, Foundries Division, Jackson Industries, Inc., spoke on "What Makes a Good Casting." Using the apprentice made castings, he pointed out the results of the special types of gating used and indicated how each form met different needs.

J. L. Corley, Southern Precision Pattern Works, spoke on "Some Fine Points of Good Patterns." Mr. Corley emphasized the importance of apprentice training and the development of skilled men in all the trades. Mr. Corley himself recalled that he was a winner in a Birmingham A.F.S. sponsored apprentice contest twelve years ago.

Oscar Wyatt, Acme Pattern Works, also emphasized the necessity for complete accuracy in pattern making. He served as one of the judges in the local contest.

Contest prizes of $50.00 E Bond for first, $25.00 E Bond for second and $10.00 Defense Stamps for third place were awarded to the winners in each of the five divisions of the contest.

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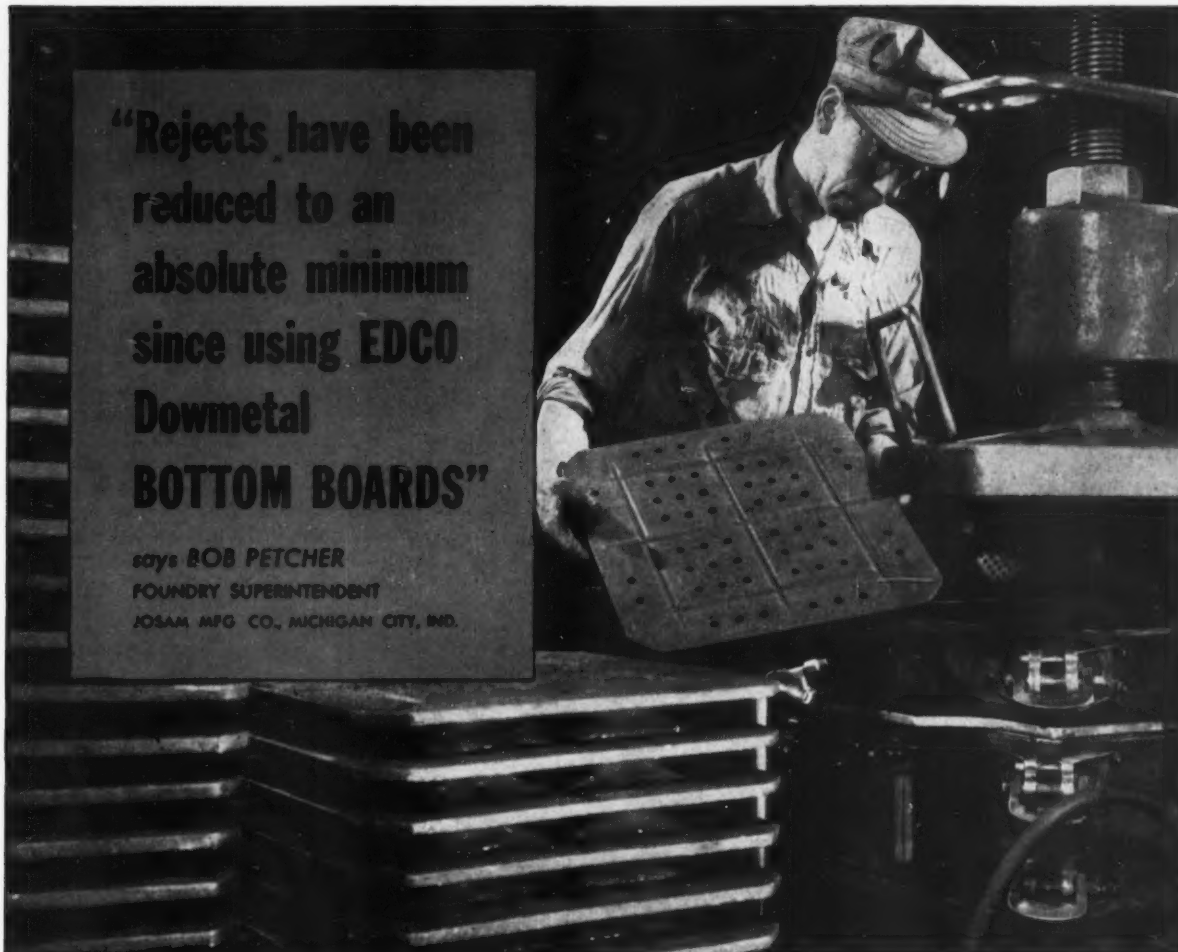
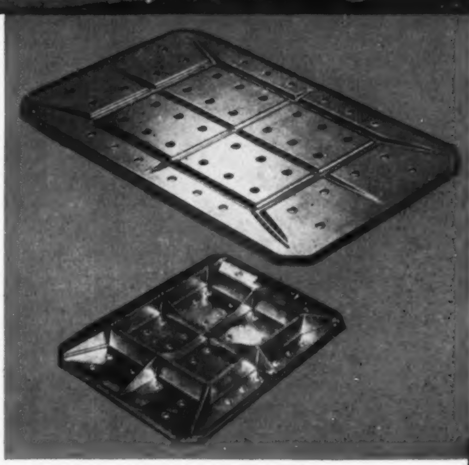


EDCO DOWMETAL Bottom Boards in use at Josam Manufacturing Company, world's largest manufacturer of plumbing drainage products



"Light, easy to handle, practically everlasting, EDCO DOWMETAL Bottom Boards have been a potent factor," says Petcher, "in improving our quality of castings and increasing our output.

"Our old wood boards had a life of about two weeks; and toward the end of their life-span, they always produced some poor castings which had to be rejected.

"EDCO Boards are just the opposite—they are *permanent equipment.* We've been using EDCO DOWMETAL Bottom Boards for more than four years—have used them almost 10,000 times—and they are still in perfect condition.

"These boards have paid for themselves many times over."

You, too, can save time, space and substantial cash sums by using EDCO DOWMETAL Bottom Boards.

They're easy to handle—light. They stack in small space, easily and securely. They last indefinitely—built for it.

Above all, like Josam, you get better castings, fewer rejects—a big saving.

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Convention

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pinholes in copper-base and ferrous castings, respectively, and Mr. Gardner commented on aluminum castings. In aluminum castings, Gardner said, pinhole porosity is usually defined as generally distributed porosity with occurrence and distribution influenced by dissolved hydrogen, cooling rate, and alloy composition. Such porosity should not be confused with small blow holes caused by trapped gas bubbles, or with localized shrinkage voids caused by imperfect directional solidification, he warned.

Individual voids which make up pinhole porosity in a casting usually resemble one another closely in size and shape wherever cooling conditions are about the same, but in castings made under different conditions the voids may range in size from microscopic to quite large, and in shape from spherical to sharply angular depending upon the relative strength of influencing factors. As an example, Mr. Gardner said that rounded voids are most likely to occur in alloys having a narrow solidification range and are favored by high gas content of the melt and by rapid solidification rates. Angular voids, he declared, are most likely to be formed in alloys having a wide solidification range when cast under conditions of low gas content and slow cooling.

Best conditions for avoiding or minimizing pinholes in any cast aluminum alloy, Gardner stated, are those in which metal of low gas content is transferred without gas pick-up to adequately-vented molds in which the metal solidifies rapidly.

Steel

Meetings of the Steel Division at the Convention included three technical sessions and a round table luncheon. Seven papers were presented at these meetings, in addition to round-table discussions.

Chairman of the first session was C. B. Jenni, General Steel Castings Co., Eddystone, Pa. He was assisted by Co-Chairman J. R. Goldsmith, Crane Co., Chicago. A paper on *"The Influence of Molding Materials on the Incidence of Hot Tearing,"* by J. M. Middleton, British Steel Castings Research Assn., Sheffield, Eng., was read by C. W. Briggs, Steel Founders' Society of America, Cleveland. The second paper, *"Progress Made in Fluidity Testing of Molten Metal During the Last Ten Years,"* was presented by J. H. Schaum, National Bureau of Standards, Washington, D. C. for the author, A. J. Krynitsky, National Bureau of Standards, Washington, D. C., retired.

Mr. Middleton's paper presented data relative to the range of temperature and to the time after pouring within and at which hot tearing occurs. His investigations sought to develop a test to measure amounts of hindrance to contraction offered by various molding media under different casting conditions, and the incidence of tearing in the casting. Variations in ramming density, bond content, and grain size of the molding media, and in casting temperature of metal, upon the incidence of tearing in the casting, were also studied. This paper is being reprinted in two parts in the American Foundryman, part I of which appears in this issue.

Evaluation of fluidity is empirical at the present time, according to Mr. Krynitsky's paper. He maintained that the term "fluidity" itself should be established as purely a foundry usage. Standardization is needed if such a value is to be measured. Various methods proposed by investigators were referred to. Temperature of molten metal entering the flow channel is the most critical factor in fluidity determination, the author continued. He concludes that a standard method and procedure should be adopted by A.F.S. to assist in fluidity testing of foundry alloys.

Joined Sections

Second of the steel sessions was under the chairmanship of A. H. Suckow, Symington-Gould Corp., Depew, N. Y. Co-chairman was K. Fritz, Bucyrus-Erie Co., So. Milwaukee. Papers presented were: *"Feeding Range of Joined Sections,"* by E. T. Myskowski, H. F. Bishop, and W. S. Pellini, Naval Research Laboratory, Washington, D. C.; and *"Fundamentals of Riser Behavior,"* by C. M. Adams and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

Messrs. Myskowski, Bishop, and Pellini investigated the distances to which joined cast steel plate sections of various thicknesses and lengths could be

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William Busby, Texas Foundries Inc., speaks on cost standards. Others, (l. to r.): R. T. Lewis, Keen Foundry Co.; Co-Chairman C. E. Westover, Westover Engineers; and Chairman R. L. Lee, Grede Foundries, Inc. →

At left, safety is topic of F. W. Shipley, Caterpillar Tractor Co. Listening: meeting Chairman J. W. Young, International Harvester Co.; and W. N. Davis, A.F.S.

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fed with soundness, and reported the results. Generally, they found that the mutual effects of joined dissimilar sections usually contribute to a reduction of feeding distance in the larger section, and increasing the feeding distance in the smaller beyond that obtainable in the same sections cast separately. These effects were found to be reversed, said the authors, in very large or very small thickness differences.

C. M. Adams and H. F. Taylor collaborated in reporting the fundamentals of riser behavior. Their work made use of a quantitative approach to riser design which employs a heat and material balance to evolve an engineering riser equation. Chills, insulators, radiation, superheat, and other modifying effects were evaluated in developing the equations. Generally, a quantitative comparison with previous work in the field showed good agreement between theory and practice for steel castings. The authors' paper was a supplement to some of the earlier investigations in steel, and they presented a "riser equation" that is applicable for risering castings of any metal under average production conditions.

Last of the steel technical sessions featured two papers. *"Performance of Cast and Rolled Steels in Relation to the Problem of Brittle Fracture,"* by W. S. Pellini, F. A. Brandt, and E. E. Layne, Naval Research Laboratory, Washington, D. C.; and *"Engineering Aspects of Centrifugal Casting,"* by J. F. Wallace, Watertown Arsenal, Watertown, Mass.

In discussing brittle fracture, the authors compared the inherent characteristics of cast steels in relation to rolled steels of equivalent metallurgical type. Charpy V and Keyhole notch toughness properties of cast and rolled steels are similar, they demonstrated. They showed that resistance to brittle fracture is exactly the same.

Fracture types were outlined, together with the mechanical aspects of brittle fracture. The relationship between temperature and strain rate was delineated. Bulge, crack propagation, and drop-weight tests were used in compiling the data used in the paper.

Centrifugal Casting

Mr. Wallace explored the engineering factors involved in centrifugal casting. He described the several processes, including the true centrifugal method in which the mold is spun about its own axis, and which is widely used for cast iron pipe, gun tubes, and cylinders of steel, heat resistant metals, and copper-base alloys.

Another version, the vertical axis, true centrifugal process, is employed in manufacturing cylinder barrels, short tubes, gears, and liners. A semi-centrifugal method is used for other associated purposes. Metal and sand molds, the author reported, are employed for true centrifugal castings, but the semi-centrifugal and centrifuged processes usually use sand molds.

Centrifugal casting is now competing with forging and static casting processes. Dimensions, quality, and volume requirements dictate the most economic production method. Although centrifugal casting is no panacea, it has a well defined field, within its limitations.

The Steel Round Table Luncheon was presided over by J. B. Caine, Cincinnati; V. E. Zang, Unitcast Corp., Toledo, Ohio, was co-chairman.

A paper, *"Hot Tear Investigation—A.F.S. Steel Research Progress Report,"* was presented by C. H. Wyman, Burnside Steel Foundry Co., Chicago. Mr. Wyman reviewed past work in this field by the Armour Research Foundation, under A.F.S. sponsorship. In 1950-51, the Armour hot tear test casting showed much promise from a reproducibility and sensitivity standpoint. The committee had agreed in 1952 to continue the investigations into hot tear testing and high temperature properties of sand. In addition, a cooperative program was to be developed with selected operating foundries. The Society will provide necessary pattern equipment in a further study of the value of the Armour hot tear test casting. Mr. Wyman reviewed the progress made at each of seven cooperating foundries in the Chicago area in his report.

Safety & Hygiene & Air Pollution

The Safety & Hygiene & Air Pollution Committee sponsored four sessions. The first covered *"What Are Future Air Pollution Prospects for the Foundry Industry?"* by J. M. Kane, American Air Filter Co., Louisville, Ky. This was followed by *"Know Your Problem for Your Community"* by R. T. Greibling, Air Pollution Control Assn., Pittsburgh, Pa. *"Air Pollution Control Equipment Available for the Foundry Industry"* by R. T. Pring, American Wheelabrator & Equipment Corp., Mishawaka, Ind., closed the first session. A *"Progress Report—A.F.S. Safety & Hygiene & Air Pollution Program"* (pages 79-82 this issue) by J. R. Allan, International Harvester Co., Chicago, opened the second session. This was followed by *"Noise in the Foundry"* by H. T. Walworth, Lumbermen's Mutual Casualty Co., Chicago. A discussion of *"Trends of Dust Control—Past, Present and Future"* was the subject of the third meeting. Discussion leaders were: K. J. Caplan, Consultant, St. Louis; K. M. Smith, Caterpillar Tractor Co., Peoria; and A. G. Granath, National Engineering Co., Chicago. *"Positive Benefits of a Safety Program"* by F. W. Shipley, Caterpillar Tractor Co., Peoria and a Question and An-

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(Left) W. S. Brunk, Headford Bros. & Hitchins Foundry Co., and President, National Foundry Assn., is shown at President's Reception with Mrs. Brunk and C. T. Sheehan, NFA Executive-Secretary. (Right) Dr. J. T. Mackenzie (left), President, Foundry Educational Foundation and Vice-President, National Castings Council, chats with C. O. Burgess, Technical Director, Gray Iron Founders' Society; Dr. G. H. Clamer, Past-President, A.F.S.; and R. E. Kennedy, Secretary-Emeritus, A.F.S.

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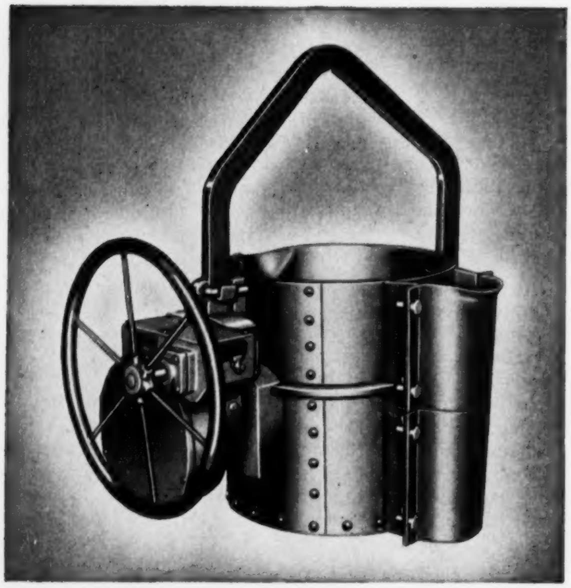

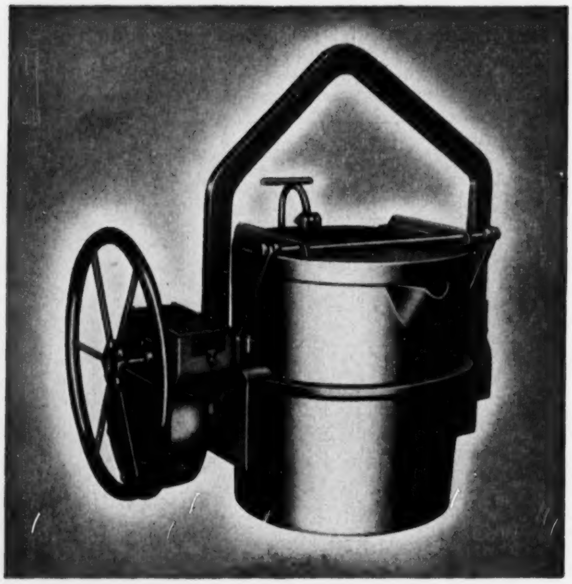

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swer Panel were covered in the fourth session.

Looking into the future, Mr. Kane said, the foundry with high efficiency, dry centrifugal, good wet collectors or fabric arresters controlling snagging, swing frame, and portable grinding have little to worry about more stringent controls for those operations.

To date, he said, the foundry industry has made little effort to tell community or control groups about their extensive and effective air pollution control installations. It is possible that such a program at the community level would do much "public relations" good, would forestall public criticism based on lack of information, and could even be helpful in giving the control authorities a better understanding of the air pollution control efforts and expenditures which actually are far above those of many other segments of dust producing industries, he concluded.

Air Pollution Problems

Mr. Griebling divided his address into two general sections. The first was a general description of present-day air pollution control problems as they affect both industry and the public, and the second part was the story of the Air Pollution Control Association and the part it is playing to bring a cleaner air to urban communities internationally. Principal source for offense in the field of air pollution is industry, with its potentialities for discharging huge quantities of nuisances into the surrounding air, he said. However, much of this can be and is being controlled, for industry has found it increasingly necessary to make heavy investments in air pollution control equipment if it is to keep the status of a good neighbor, it was pointed out.

The public is very definitely interested in cleaning its aerial sewage. Eternal vigilance is necessary, however, to keep good programs working. Most important, in this connection, he said, is to keep the administration of air pollution control legislation out of politics. This can be done by having a body of public-spirited citizens consecrated to the task ahead. Secondly, it is most desirable to create an advisory committee of scientifically educated persons whose duty it is not only to help solve the many intricate problems, but to give advice, where needed, to the air pollution control bureau on subjects beyond the knowledge of the personnel of such bureaus, it was pointed out.

Industry can play a leading role in such a set-up, Mr. Griebling declared. It can institute and finance research looking to the solution of those problems for which today there is no practical and economical answer, he said. It can contribute to the general fund of knowledge everything that it knows concerning the reduction of pollution. It can help staff the technical advisory committee, and it can practice what it preaches with sincerity. Industry has come to realize that reduction in atmospheric pollution is one of the best methods of making its community a better place to live in, for its employees as well as for others, Mr. Griebling concluded.

Defective Hearing

Mr. Walworth pointed out that the growing interest of management in industrial noise problems is brought about by the prospect that loss of hearing among workers exposed to excessive noise may be considered compensable in certain states. He stated that it has been estimated that between 15 and 20 million adults in this country have defective hearing. Exposure to excessive industrial noise is only one of the causes of defective hearing, and thus industry is faced with the prospect of assuming responsibility for impaired health which was not caused by conditions of employment, he said.

Some of the more important items needing further research and study at this time, he said, are: (1) The development of permissible safe noise levels; (2) Practical procedures for determining or evaluating hearing loss. While pure tone audiometers are in common use, the procedure for operation in actual use may be subject to criticism because test room background noise will usually exceed the decibels of hearing loss being tested. Medical departments and audiometric testing rooms in areas with noise levels below 50 decibels (commonly recommended) do not seem practical for most industrial facilities; (3) Procedures for evaluating relative or percentage hearing loss; (4) Specifications for construction of acceptable rooms for audiometric testing; (5) Practical medical control programs for the noisy trades; (6) Evaluation of permanent hearing loss in relation to time of last exposure; (7) Measurement of impact noises; (8) Noise control.

The evaluation of foundry noises presents many problems because of the great variety of operations and the influence one operation has on noise exposure at another, Mr. Walworth stated. Open windows tend to decrease noise exposures (by reducing reflections), and the construction of walls or the installation of metal shields may increase exposure by increasing reflections, he said. Plant layout and arrangement of equipment also affects the noise level. So does an increase or decrease in the number of operating machines, he pointed out.

Because of the many variables in noise exposure, it is possible that noise levels inside a foundry may change one, or more decibels in any octave band from day to-day, he said. Likewise, he said, the noise exposures for similar operations may vary from one foundry to another. The noise produced by a machine depends on its size, weight, speed, mounting, location with respect to other machines and re-

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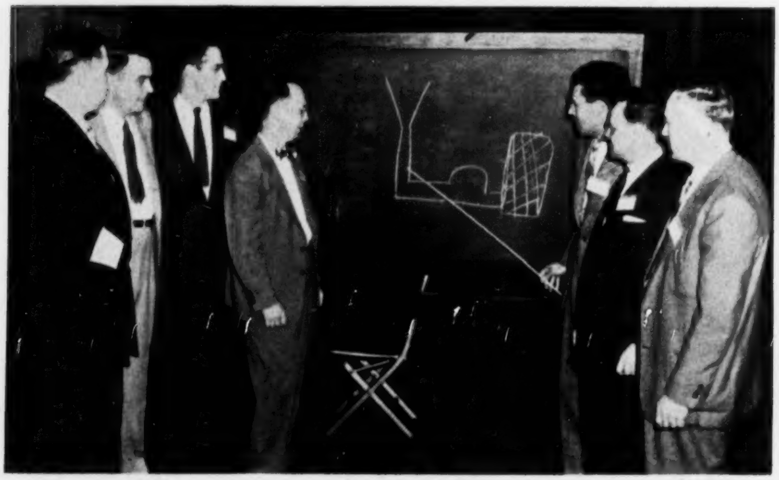

Sand Shop Course Chairman H. Brown, Solar Aircraft Co., points to blackboard. Watching are (l. to r.): G. P. Antonic, Motor Castings Co.; G. W. Anselman, Beloit Foundry Co.; R. H. Olmsted, Whitehead Bros. Co.; W. B Scott, American Brake Shoe Co.; C. E. Maddick, Massey-Harris, Ltd.; and J. B. Stazinski, General Electric Co.

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flecting surfaces, and state of repair. In general, noise spectra are concentrated in the higher frequencies, an area potentially damaging to the ears of exposed workers, he asserted.

First step in noise control is evaluation of the potential hazard, followed by a program of re-evaluation as exposures are controlled or improvements made, he pointed out. Considerations to bear in mind when controlling noise at its source he said, are: (1) Determine the vibrating surfaces; (2) Reduce area and number of vibrating surfaces; (3) Avoid vibrating or impact forces; (4) Avoid high frequency vibrations, (a) Control by increasing weight, (b) Decreasing speed; (5) Use rubber or other dampening materials wherever possible; (6) Provide regular maintenance.

The Canadian Dinner brought out a large group, including (l. to r.): Andrew Reyburn, Cockshutt Farm Eqpt., Ltd.; W. W. Maloney, Secretary-Treasurer, A.F.S.; A. J. Moore, Montreal Bronze, Ltd.; J. J. McFadyen, Galt Malleable Iron Co., Ltd.; J. A. Wotherspoon, J. A. Wotherspoon & Son, Ltd.; and I. R. Wagner, President, A.F.S.

Suggestions

Other suggestions he made were: Substitute less noisy operations or machines; increase distance between source and worker; construct barrier between noise source and worker; reduce noise reflections by absorption; reduce exposure time and provide personal protection. In conclusion, Mr. Walworth stated that while permissible noise exposure levels have not been definitely established, sufficient data are available which at least classify noise operations into "excessive", border-line" and "safe" categories.

Mr. Caplan discussed dust control and allied problems from the following aspects: attitudes of management, labor and the general public; available design data and knowledge; practice in design procedure; educational aspects –with particular regard to engineering; equipment trends–in dust-producing equipment as well as in dust control equipment; and the results obtained from the above factors.

Health Hazards

In the past, he said, design procedures were poor, plants being constructed usually with absolutely no regard to the dust control problems. What dust control was installed was added afterwards, in make-shift fashion, at high cost and frequently left much to be desired in the way of results. At the present time, Mr. Caplan went on to say, we find enlightened industry quite ready to admit the potential hazards–both health and economic–of the dusts, fumes, and atmospheric pollution associated with industry. Quite a few industries point with pride to their accomplishments in the elimination and control of such problems, and show resistance to the admission of the problems only when an unreasonable, rabble-rousing, non-scientific demand is made. We may expect more and more "dust producing equipment," he concluded, to be furnished with built-in dust control of one form or another.

Off-shift Meetings

Mr. Shipley suggested the phrase "The Safe Way Is The Best Way" be changed to "The Safe Way Is The Only Way." He went on to outline some of the steps taken by his company with regard to their safety program. Off-shift monthly safety meetings attended by all levels of supervision are held around the clock, he said. Arrangements are made for a different supervisor to lead each monthly meeting of his own shift. This fact alone helps further the safety program, he said, because one cannot help but be more safety conscious after having led one of the meetings.

A committee of supervisors was also set up to inspect the shop daily for cleanliness and orderliness. The men on this committee inspect departments other than their own and make reports individually at the regular monthly safety meetings, he said. Protective equipment and a licensing program for motive power operators were also included in the program, he said, and the results show that accidents have been materially reduced since the program was inaugurated.

Safety is a never-ending program of education and constant effort, Mr. Shipley said, and we must be alert and stop unsafe practices on the spot. Any program of safe practices is no better than the desire to make it real, he concluded, adding that accidents can and must be prevented.

The program on plant and plant equipment consisted of a talk on *"Core Making Machines"* by L. B. Koenig, J. I. Case Co., Racine, Wis., and a motion picture, *"Mechanization in Core Making,"* shown by H. C. Weimer, Beardsley & Piper Co., Chicago (This year's presentation rounds out the series on molding and coremaking started by the Plant and Plant Equipment Committee last year. The papers will be available as a separate publication later this year.)

Core-blowing Advances

Mr. Koenig said experience and records show that through the use of core blowers in place of the old conventional manual coremaking, production can be increased and labor costs reduced. One of the recent advances in core blowing uses the multiple station blower, he said. This consists of a five station turntable with automatic blowing, rollover and draw.

I think, he concluded, we can all agree that we owe a tribute to the manufacturers of coremaking machinery for the spectacular improvement of their products, which has enabled the

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coreroom to advance from the proverbial "hole in the wall" to a most essential and integral part of the foundry of 1953.

The Refractories Committee sponsored two sessions of three papers each. At the first session the speakers and their papers were: C. C. Spencer, Electric Steel Castings Co., Indianapolis, *"Insulating an Acid Electric Furnace Roof"*; F. W. Jacobs and J. S. Lawrence, Jr., Texas Foundries, Inc., Lufkin, Texas, *"Correlation of Air Furnace Bottom Temperature to Refractory and Operating Practice in a Cupola-Air Furnace Duplex System;* M. G. Dietl, Schaible Foundry & Brass Co., Cincinnati, *"Refractories for Indirect Arc Electric Furnaces for Non-Ferrous Melting."* C. H. Wyman, Burnside Steel Foundry Co., Chicago, presided and R. A. Witschey, A. P. Green Fire Brick Co., Chicago, was co-chairman.

V. E. Zang, Unitcast Corp., Co-chairman of Steel Round Table Luncheon, points to program held by J. B. Caine, Consultant, Cincinnati, Chairman. C. B. Jenni, General Steel Castings Co. (standing); and W. S. Pellini, Naval Research Laboratory, (seated left); and C. H. Wyman, Burnside Steel Foundry Co., watching.

Insulation of the furnace roof performs a number of functions, Mr. Spencer said, which justify the cost of material and the labor to apply it. Some of the advantages are, he said: (1) The 1 in. of insulation is equivalent to 7 in. of fire brick; (2) It gives more uniform power consumption; (3) It keeps iron oxide away from the bricks, and doesn't allow it to work down in the cracks where it would tend to erode the bricks faster; (4) It serves as an electrical insulator between cooling rings.

Bottom Life

Mr. Jacobs said that experimental work done during a 10-month period of regular malleable production, using the air furnace of a cupola-air furnace duplex system, indicates that measurement of bottom temperature is a definite aid in predicting bottom life. It should be a useful control tool, notably in foundries limited to the use of one air furnace where bottom failure in the middle of the week would seriously handicap production, he said.

The speaker used graphs to compare results and show differences in retained bottom temperatures as related to amount of ventilation on the furnace bottom, size and type brick, variable construction and operation methods, slag treatment and effect of intermittent operation of furnace. Method of furnace construction was shown including the method of placing the thermocouples under the service bottom for temperature measurement.

Mr. Dietl pointed out that one time fire clay brick type refractories were supplemented with mullite type refractories in a furnace to produce a "balanced" unit—one in which failure of all parts will occur simultaneously. The objective was to produce maximum tonnage or output at lowest refractory cost per ton. In recent years, however, due to high labor rates and the desire for longer life and furnace availability, the 100 per cent mullite type of refractory has gained a great deal in popularity, and in most cases has shown economy, he said.

Even after long experience, both the manufacturer and user of refractories cannot make definite recommendations due to variations in service conditions —not the least of which is the human element. He pointed out that the best refractory for the job can be determined by considering these factors.

Papers at the second refractories session were: *"Gun-Placed Silica Cupola Linings,"* T. E. Barlow and P. D. Humont, International Minerals & Chemical Corp., Chicago; *"Effects of Operating Practice on Refractory Life in the Periodic Air Furnace,"* C. F. Semrau, Illinois Malleable Iron Co., Chicago; and *"Carbon as a Refractory,"* J. V. Nolan and T. J. Wilde, National Carbon Co., New York. W. R. Jaeschke, Whiting Corp., Harvey, Ill., presided and R. P. Schauss, Werner G. Smith, Inc., Chicago, was co-chairman.

Mr. Barlow said that the outstanding change in the process now known generally as "gun patching the cupola" has been in the use of the process itself and its acceptance by the industry. At present, he said, more than 50 per cent of the gray cast iron and more than 80 per cent of the duplexed malleable produced in this country comes from units maintained by the air-placement technique.

Fundamentals

Regardless of the type of refractory involved in cupola practice, there are certain fundamental factors which affect the refractory life, he said. Some of these factors are inherent to the operation and cannot be changed to suit the refractory. They may be considered as "occupational hazards" to the refractory, which are necessary to meet the requirements of the cupola practice. There are other factors, however, which affect the refractory but which are under the control of the operator, he pointed out.

The best refractories installed with the greatest care can be destroyed by careless operational practices, it was pointed out by Mr. Semrau. We find that carefully worked out and controlled operation is easier on our men, assures better metallurgical control and reduces labor and material costs, he said.

Close metallurgical control without the use of excessive furnace additions and adjustments as well as assurance against undue refractory failures are other benefits, he declared. Failure to follow carefully planned control results in variable heats, excessive adjust-

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The fellowship hour preceding the dinner was enjoyed by some ninety foundrymen and friends. The coffee talk speaker, Beldon Y. Cooper, U. S. Pipe & Foundry Company was introduced by Albert J. Fruchtl also of U. S. Pipe. Mr. Cooper gave a most interesting talk on "Guided Missiles."

Biddle W. Worthington, Birmingham District Chapter Chairman, presided at the meetings and Secretary-Treasurer, John F. Drenning gave the financial report. The building fund pledge was reported paid in full and a balance still in the treasury slightly above the minimum required.

Birmingham District
Chapter Officers for 1953-54:

Chairman: Biddle W. Worthington, *McWane Cast Iron Pipe Co.*, Birmingham, Ala.

Vice-Chairman: Edward E. Pollard, *Alabama Pipe Co.*, Anniston, Ala.

Sec.-Treasurer: John F. Drenning, *Kerchner, Marshall & Co.*, Birmingham, Ala.

Obituaries

WILLIAM B. RUNYAN, SR.

JAMES M. FITZWILLIAM

William B. Runyan, Sr., 75, chairman of the board of directors, Dayton Malleable Iron Co., died May 9. Mr. Runyan had been associated with Malleable Iron since 1912 when he became superintendent of one of the company's plants. He worked up through various executive positions and was president of the company from 1936 to 1942.

George W. Mitsch, 58, operating manager of foundries, American Car & Foundry Co., died April 29. Mr. Mitsch started with ACF as a patternmaker in 1915, and was appointed operating manager of foundries in 1944. He was Chairman of A.F.S. St. Louis District Chapter for two terms.

Harold J. Martin, 45, sales engineer for Miller & Co., Chicago, died May 4, after a brief illness. Mr. Martin joined the Miller organization in 1932, and at the time of his death covered the Chicago and Indiana territory.

James M. Fitzwilliam, vice-president of Foundry Equipment Co., Cleveland, died of a cerebral hemorrhage, May 7.

Herbert F. Scatchard, foundry management engineer with the Bureau of Ships, Washington, D. C., died May 3. Prior to entering Naval Service, Mr. Scatchard was industrial engineer at Birdsboro Steel Foundry, Birdsboro, Pa. Before that he was foreign contracts engineer for American Engineering Co., Philadelphia. Early training was obtained in American Steel Foundries, Chicago.

Parker H. Woods, 77, chairman of the board, St. Louis Coke & Foundry Supply Co. (formerly M. W. Warren Coke Co.), St. Louis, Mo., died April 18 from cerebral hemorrhage. He had been with the company 56 years.

William C. Royal, 48, Cleveland representative of Selas Corporation of America, died of a heart condition April 9.

Congratulations are extended by St. Louis District Chapter Chairman Henry W. Meyer (left), General Steel Castings Corp., to Chairman-Elect, Webb L. Kammerer, Midvale Mining & Mfg. Co., at May 14 meeting of the organization. Complete slate of officers and directors was announced at the meeting.

Northeastern Ohio

JACK C. MISKE
Foundry

The presence of two technical speakers marked the April 9 meeting of Northeastern Ohio Chapter of the A.F.S. Charles E. Nelson, technical director, Magnesium Department, Dow Chemical Co., Midland, Mich., spoke on "Getting the Most out of Light Alloy Castings," and Prof. Howard F. Taylor, Department of Mechanical Metallurgy, Massachusetts Institute of Technology, discussed "The Feeding of Castings."

Mr. Nelson stressed the ever increasing use of aluminum and magnesium alloys and the need of the foundry industry to capitalize on developments in the field of light metal castings in order to compete with the great presses that are being built for forgings. Recounting the advantages aluminum and magnesium offer, including the fact that there are plentiful sources of both, Mr. Nelson gave some startling figures about the availability of magnesium, which is processed from sea water.

If 100 million tons of magnesium were taken from the seas each year for 1 million years, the magnesium content of the seas would drop from 0.13 to only 0.12, even if there were no more additions. If all the magnesium in the seas could be extracted and spread evenly over all the land surface of the planet, it would form a layer 9 ft deep!

Mr. Taylor discussed the function of risers, the difficulties that arise from improper risering and means of avoid-

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Convention

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ment and excessive pouring temperatures, to say nothing of the increased labor and refractory costs, he concluded.

Mr. Wilde pointed out that carbon does not ordinarily melt, and only at the extremely high temperature of 6700 F does it sublime—that is, change directly from solid to the vapor state. Due to this fact, there is only one general method whereby it can be shaped to definite forms and that is by bonding the carbon particles with a binder which will leave a carbon residue when decomposed by heat, he said.

In many cases, he pointed out, carbon and graphite are the only materials which have been successful in meeting the severe and exacting requirements involved in handling hot metals and corrosive slags.

Timestudy and Methods

Timestudy & Methods Committee held two sessions which consisted of three papers. *"Wage Incentive for Cost and Production Control for Indirect Operators"* by C. J. Pruet, McWane Cast Iron Pipe Co., Birmingham, Ala., was the paper given at the first session. Dean Van Order, Burnside Steel Foundry Co., Chicago, presided and J. J. Farkas, Cincinnati Milling Machine Co., Cincinnati, was co-chairman. *"Developing Standard Data Tables for Core Finishing"* by L. L. Martin, Sterling Foundry Co., Wellington, Ohio and *"Conveyor Molding Standards"* by E. C. Reid, Ford Motor Co. of Canada, Ltd., Windsor, Ont., were the two papers at the second session. J. A. Westover, Westover Engineers, Milwaukee, presided; co-chairman was H. R. Williams, Williams Management Engineering, Milwaukee.

Mr. Pruet defined indirect work as that type of work which is required to indirectly assist, or service the employees who perform direct work, such as oilers sweepers, repair men, janitors, clerks, stock men, supervision, etc. With more foundries becoming highly mechanized and with rising labor costs, it is becoming increasingly important for foundry management to give more time and attention to maintenance and other indirect operations, he said. Any deficiencies on the part of indirect workers will lower the efficiencies of direct workers, if not stop them completely he pointed out.

One of the best known means of reducing indirect labor costs, which in many cases is 50 per cent or more of the total labor cost, and at the same time improve the quantity of indirect service and maintenance, is by the application of a sound wage incentive plan, he said. The establishment of task standards for this type of work is a difficult task; however experience has shown that the benefits are worth the extra trouble, it was pointed out.

It is to be assumed that any plant considering the development of standard data for core finishing has already in effect standard data for coremaking, Mr. Martain said. Certain general information is generally tabulated for each and every core for those standards, and such information may be utilized in many ways in developing the finishing standard data, he pointed out.

The development of standard data is often a time-consuming operation, but the final advantage realized from a good set of tables repays the effort expended many times over. Any timestudy man familiar with the proper technique of taking time studies, and having the imagination to visualize the problems which may be encountered and the results to be obtained, can develop good standard data tables which are complete and workable, he said.

Mr. Reid spoke of a method of developing time standards for mechanized molding lines. He referred specifically to several sets of cope and drag, jolt-squeeze machines grouped together in such a way as to feed molds to a continuously moving conveyor line. Pouring, core setting, shake-out, and other operations, are also done in conjunction with this line, he said.

In concluding, he said, a few bits of general advice, directed at anyone who is trying to deal with the problem are: (1) Formalize your regular time study policy and procedures by publishing them in written form; (2) Organize your study so that it gives time standards for costs.

Costs

Two papers were presented at the foundry cost session. Papers and authors were: *"Use of Standards in Controlling Costs,"* William Busby, Texas Foundries, Inc., Lufkin, Texas, and *"Are Your Costs Reliable?"* R. T. Lewis, Keen Foundry Co., Griffith, Ind. Presiding was R. L. Lee, Grede Foundries, Inc., Milwaukee; C. E. Westover, Westover Engineers, Milwaukee, was co-chairman.

Mr. Busby said that the first item to be included in a cost control program is that of direct labor and it is in this area that most of the standards work has been done in industry. Once methods, work place and materials have been standardized, it is a relatively easy matter to establish production standards on the operation involved, he said.

The variations between costs of different items should be consistent with their basic cost characteristics, the production processes employed and the equipment used, Mr. Lewis said. He went on to spotlight some of the more common and pertinent discrepancies inherent in costs developed from inadequate and incorrect cost systems today.

Mr. Lewis stated that it had been conceded that cost accounting cannot be practically developed to an exact science. This, he said, is particularly true in the jobbing foundry field where an infinite variety of castings are produced. It is, however, possible to enjoy the fruits of a properly improved and instituted cost system, eliminating the discrepancies most common and detrimental to success, he concluded.

Otto A. Pfaff, American Wheelabrator & Eqpt. Corp., past A.F.S. Director, greets feature speaker H. Bornstein, retired, A.F.S. President, 1937-38, at Alumni Dinner. Others, from left: Al Hilbron, A.F.S. Headquarters; William W. Maloney, Secretary-Treasurer, A.F.S.; and Thomas H. Benners, Jr., T. H. Benners & Co., former A.F.S. Director. Dinner was held on May 7 at Sherman.

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discussed all of these factors in relation to various metals and alloys and pointed out the need to vary risering methods with the use of different casting materials. Much of his talk was devoted to the uses of chills, insulators exothermic materials and other aids to correct risering.

Here are the new officers of Northeastern Ohio Chapter, elected for 1953-54:

President: S. E. Kelly, *Eberhard Mfg. Division,* Cleveland.

1st Vice-President: Dave Clark, *Forest City Foundries Co.,* Cleveland.

2nd Vice-President: Lewis T. Crosby, *Sterling Wheelbarrow Co.,* Cleveland.

Secretary: Howard E. Heyl, *Federal Foundry Supply Co.,* Cleveland.

Treasurer: F. Ray Fleig, *Smith Facing & Supply Co.,* Cleveland.

Central Ohio Chapter

WILFRED H. WHITE

The April meeting of the Central Ohio Chapter, held at the Seneca Hotel, Columbus, on April 13, featured J. H. Jackson, Battelle Memorial Institute, as the speaker. Mr. Jackson showed a color film, "Effect of Gating Design on Casting Quality," the third and most recent of a series produced at the Institute on gating practice.

A brief description of the two previous films was given before expanding into the new phase of the program. As in the previous work, plastic transparent molds were used so that any entrained gases could be seen.

Certain changes in the gates and sprue made radical differences in the behavior of the fluid, which in this case was water. Mr. Jackson pointed out that a number of trials have been made with metals, which show a very good correlation in spite of the differences between the fluids. It was brought out in the discussion that much of the material shown bears out visually-known principles of fluid mechanics.

New officers were recently elected for Central Ohio Chapter. They include: **Chairman:** C. W. Gilchrist, *Cooper-Bessemer Corp.;* **Vice-Chairman and Program Chairman:** Raymond M. Meyer, *Ohio Steel Foundry Co.;* **Secretary:** Naaman H. Keyser, *Battelle Memorial Institute;* **Treasurer:** Thomas M. Cusack, *Oliver Corp.*

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Eastern New York

A. J. Kiesler
General Electric Co.

On Tuesday evening March 17, 1953, the Eastern New York Chapter of A.F.S. in a joint meeting with the Eastern N. Y. Section of A.S.M. heard Mr. Richard Herold of the Borden Company discuss shell molding.

Dick Herold has been connected with the "C" process almost from its inception. He was therefore able to present to the combined meeting an excellent review of shell molding's progress from its beginnings in this country.

"If the part can be improved as to dimensional finish and there is a reasonable quality to be made, then such a casting should be seriously considered for the process." This was the primary thought of Mr. Herold's address. He then proceeded to highlight his talk with a number of sample castings made in shells as well as illustrate his talk by means of slides.

To lend local color to the assembly, Stan B. Terhune of the Watervliet Arsenal took to the podium to describe the work being done in the area with shell molds.

Together, Messrs. Herold and Terhune answered the many questions from the floor by both foundrymen and users of foundry products. Over 90 persons filled the meeting room at the Circle Inn, Lathams, N. Y., to overflowing.

Central Michigan

Don I. Huizenga
Albion Malleable Iron Co.

The April 15th meeting of the Central Michigan Chapter of the American Foundrymen's Society was held at the Hart Hotel in Battle Creek, Michigan. After dinner was served, Chairman Dave Boyd called on various committee chairmen for their monthly reports.

Don W. Gaertner, Albion Malleable Iron Co., spokesman for the nominating committee, presented nominations for the coming year. Don Champion, Champion Industries, reported on the annual outing which is to be held at Duck Lake Country Club. Program Chairman Albert Doess, Midwest Foundry, Coldwater, Mich., presented the speaker of the evening, Richard

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Herold, Borden Co., New York. Mr. Herold gave an excellent presentation on shell molding in which he mentioned types of metals successfully cast, size and shapes of casting presently being cast, and the names of many industries taking advantage of the shell molding process. As stated by Mr. Herold, two factors are necessary to assure the economic feasibility of shell molding, namely, (1) sizable production runs, and (2) castings as presently being produced must require some type of finished machining. One typical shell molded casting as presented by Mr. Herold showed machining costs of $27.40 as cast in green sand and $18.00 in the shell molding process.

Considerable importance was placed on the advantages of this process in the foundry itself.

Mr. Herold showed slides of shell castings and shell molds as well as numerous shell molds and cores. Following a lengthy question and answer session, the meeting was adjourned.

New Chapter officers are: **Chairman:** John E. Wolf, *Midwest Foundry Co.*, Coldwater, Mich.; **Vice-Chairman:** Lachlan Currie, *Gale Mfg. Co.*, Albion, Mich.; **Secy-Treas.:** Gerald D. Strong, *Homer Foundry Corp.*, Coldwater, Mich.

Corn Belt Chapter

VERN HOLMES

A small but eager group of Corn Belt Foundrymen met at the Rome Hotel in Omaha, Nebraska, to hear J. S. Schumacher, of Hill & Griffith Co., Cincinnati.

His subject—"Foolproof Sand Works for a Wide Range of Castings"—was well delivered, well received and certainly well discussed.

Oregon Chapter

BILL WALKINS
Electric Steel Foundry Co.

"Basic Electric Arc Furnace Metal for Castings Production" was the subject of a talk delivered at the A.F.S. Oregon Chapter's April meeting by V. E. Belusko, assistant chief metallurgist, Electric Steel Foundry, Portland, Ore. Mr. Belusko described the single slag basic electric melting process used at Electric Steel Foundry Co., and pointed out its advantages over acid melting and double slag basic melting:

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among other things, ninety-five percent recovery of alloys, extremely low refractory costs, and savings in time and power. Electric Steel Foundry Co. produces a wide variety of castings by this process in low alloy heat treatable steels and high alloy stainless steels, ranging in weight from a few ounces to several tons.

"The recovery of alloys is in itself reason enough for making the single slag basic process practically mandatory in this day of material shortages," Mr. Belusko said.

Members of the Oregon Chapter were invited to attend the annual dinner meeting of Oregon State College Student Chapter at the college in Corvallis, Oregon, May 13.

Carl P. Irwin, Ingersoll-Rand Co., Seattle, Wash., representing the chairman of the Washington Chapter, announced that the fourth annual Northwest Regional Conference would be held in Seattle at the New Washington Hotel, October 16 and 17, and outlined a tentative program.

New officers have been elected for 1953-54: **Chairman:** James T. Dorigan, *Electric Steel Foundry Co.;* **Vice-Chairman:** Phillip J. Laugen, *Oregon Steel Foundry Co.,* Portland; **Secy-Treasurer:** Robert Bieber, *Balfour, Guthrie & Co., Ltd.,* Portland.

Missouri School of Mines

Sid Cole

William M. Petersen, M. A. Bell Co., St. Louis, was the speaker at the April meeting of the Missouri School of Mines Student Chapter. He spoke on core binding ingredients.

Mr. Petersen pointed out that the sand used in the production of castings is usually from the closest and cheapest source. This practice makes binders very important to overcome many deficiencies of the sand.

The desired properties of a core sand are green strength for moldability, dry strength for strength after baking, and hot strength when the cores are subjected to the high temperatures of molten metals. The proper bonding of the sand gives these properties in the required proportions.

Defects in castings are often due to cores and molding sand. Fins and fishers on large metal sections can be cured by retarding the collapsibility of the core. This may be accomplished by the addition of hot strength binders such as western bentonite or fire clay.

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Other defects including tears, buckles, rat-tails, and scars are due to just the opposite effect, which is insufficient collapsibility. Collapsibility is increased using anti-hot strength compounds. Dextron and cornflour accomplish this purpose. They burn out at lower temperatures leaving voids for the hot sand to expand into.

Careful examination of defective castings is necessary in the determination of the cause. Proper binders may be applied at specific spots causing trouble in either the core or the mold. The proper composition of sand and core binding ingredients may be found by this examination and the yield may be increased.

Guests at the meeting included John Williamson, M. A. Bell Co.; Norman L. Peukert, Carondolet Foundry; and William J. Ruprecht, National Bearing Div., American Brake Shoe Co.

The announcement that applications for the Foundry Educational Foundation Scholarship are due was made. These scholarships are due mainly to contributions from St. Louis member foundries. Through these scholarships and the competition for them, the student interested in the foundry is encouraged. This and the participation of St. Louis foundrymen have made the A.F.S. one of the finest organizations on the campus.

The Missouri School of Mines chapter of A.F.S. has elected officers in preparation for the 53-54 school year. The chapter chose Ralph Hollocher, of St. Louis, to succeed Jack Wheeler, also of St. Louis, as President. Vice-Presidential duties fell to Daniel Groteke, of St. Louis, who will relieve Ralph Moeller of Chicago. Others elected were: James Hubeli, Secretary Treasurer; Tony Selvaggi, Membership Chairman; William Griffin, Program Chairman; and Robert Skaggs, Chapter Reporter. The retiring officers handled themselves capably, and we expect those just elected to do as fine a job. The society held its annual spring outing at Meramac Springs. Although cool weather somewhat dampened spirits all of the members enjoyed themselves.

St. Louis District

Fred J. Boeneker
Bronze Alloys Co.

Feature of the May 14 meeting was election of officers. Named to head the St. Louis District Chapter of A.F.S. as

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Chairman is Webb L. Kammerer, Midvale Mining & Mfg. Co., St. Louis. Also elected are: Fred J. Boeneker, Bronze Alloys Co., **Vice-Chairman;** Paul E. Retzlaff, Nordberg Mfg. Co., **Secretary;** and John H. Culling, Carondelet Foundry Co., **Treasurer.**

Directors elected for term expiring in 1956 are: Dale Arnette, Arnette Pattern Co., Granite City, Ill.; John O'Meara, Banner Iron Works, St. Louis; R. O. Tibbals, American Steel Foundries, Granite City, Ill.

For terms expiring in 1954: J. H. Williamson, M. A. Bell Co., St. Louis; A. E. Shelton, Shelton Pattern & Eng. Co., St. Louis; J. H. Culling, Carondelet Foundry Co., St. Louis; and F. T. O'Hare, O'Hare's Brass & Aluminum Foundry Co.

For terms expiring in 1955: R. M. Hill, East St. Louis Castings Co., E. St. Louis; J. A. Cannon, Duncan Foundry & Mach. Co., Alton, Ill.; W. C. Pickles, American Brake Shoe Co., St. Louis. Past Chairman Henry W. Meyer, General Steel Castings Corp., Granite City, Ill., will serve as a member of the board.

During the meeting a period of silent prayer was observed in memory of two recently departed members: George W. Mitsch, American Car & Foundry Co., St. Louis, who was well known in A.F.S. national affairs and who served as St. Louis Chapter Chairman during 1931-32 and again in 1936-37; and Parker H. Woods, Chairman of the Board of St. Louis Coke & Foundry Co. (formerly M. M. Warren Coke Co.), who served his company for 56 years and who was well known for his many civic and charitable undertakings in the St. Louis metropolitan area.

Two sound films were shown: Baseball World Series of 1952, and "Men and Molds" showing operations at the Lynchburg Foundry Co.

Approximately 95 members attended the meeting.

Central New York

HAROLD BRAKEMAN
City Foundry Shop

The Central New York Chapter had 80 members and guests turn out for this season's last technical session and election of officers.

With announcement of Robert Carpenter and Charles Carr, New York Air Brake Co.; George Vimmick, James King and Howard Thayer, Bennett Ireland Co., Norwich, New York;

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Elliott Hooper, Hooper Equipment Co.; Howard Leisner and Archibald Coats, Crouse-Hinds Co.; and Dennis Joyce, Instructor at Cornell University, as new members, the chapter filled its new member quota for this year.

Our officers for the coming year were elected unanimously. They are:

Chairman: John A. Feola, *Crouse-Hinds Co.*

Vice-Chairman: Joseph Gibson, *Sweets Foundry, Inc.*

Secretary: James O. Ochsner, *Crouse-Hinds Co.*

Treasurer: William Mader, *Oberdorfer Foundries.*

Directors—Term Expires 1956: R. W. Colloggi, Gould Pump Co., Seneca Falls, N. Y.; Harold Brakeman, City Pattern Works, Syracuse, N. Y.; James Palmer, Ingersoll-Rand Co., Painted Post, N. Y.

Retiring Chairman—Director for 1 year: Don J. Merwin, Oriskany Malleable Iron Co., Oriskany, N. Y.

John Ludwig, Jr., service manager, Electro Metallurgical Co., was the main speaker of the evening. He attacked his subject, "Grey Iron Metallurgy," from the standpoint of metallurgical control in the iron foundry.

It was pointed out that carbon imparts castability to the iron and, in the form of graphite, gives machineability. Silicon, on the other hand, is a stiffener.

Gray iron was divided into three types, the high carbon iron used for medium to thin section work, the intermediate or carbon equivalent types which are used most widely, and the high test irons. The advantages and disadvantages of each type were pointed out.

Mr. Ludwig made a fine presentation of a broad subject in a short time.

Next month we finish the season with our annual clambake which will be held in Binghamton this year.

Twin-City Chapter

R. J. Mulligan
Archer-Daniels-Midland Co.

This final meeting of the 1952-53 season completed the year on a purely entertaining note. L. P. Robinson, vice-president, Archer-Daniels-Midland Co., Cleveland, presented his personal documentary on "chicken farming" as

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he lived it. This now-famous talk represented an abrupt, but refreshing, change from the year's activities.

J. W. Costello, American Hoist & Derick Co., St. Paul, retiring chairman of the Twin-City Chapter, cited his several committeemen for their splendid efforts throughout the year. Specially commended were: R. Wilson, chief metallurgist, American Hoist and Derrick Co., for his work as chairman of the Technical Sessions Committee; and J. D. Johnson, Archer-Daniels-Midland Co., for the outstanding job done by the Educational Committee, which Mr. Johnson directed.

The Educational Committee arranged three field trips for students and apprentices over the past year. Nov. 11, 1952, a group of 50 visited Minneapolis Electric Steel Castings Co.; February 17, 1952, at Minneapolis-Moline, Lake Street Plant, 80 members, students, and apprentices met; and at American Hoist & Derrick Co., on April 28, 1953, a group of 66 enjoyed the combined Castings Defects Committee monthly round-table, and plant visit.

As result of the efforts of the Educational Committee toward organizing these popular plant visits and other inducements to introduce the foundry industry to the students of this area, twelve student members were added to the membership roles this year.

Loren Selvog, apprentice, American Hoist & Derrick Co., placed highest of all Twin-City area apprentices in the National Contest. Although his eighth place in the Steel Molding Division and thirteenth in the Gray Iron Molding Division did not win national awards, the Twin-City Chapter did present him with a check for $25 for placing highest among the Twin-City entries.

The Annual Twin-City Chapter Golf Outing for 1953 was announced for August 3, 1953, at Midland Hills Country Club. J. Garski, Progress Pattern & Foundry Co., St. Paul, repeats this year as chairman of the committee.

O. J. Myers, technical director, Archer-Daniels-Midland Co., Foundry Products Div., was presented with a gavel signifying his coming term as chairman of the Twin-City Chapter. J. W. Costello, retiring chairman, had personally made the gavel as a gift from the chapter. New vice-chairman is Arthur W. Johnson, Northern Malleable Iron Co., St. Paul.

Chapter Meetings

June

13 . . Central Illinois
497 Club, Groveland, Ill. Annual stag.

13 . . Toledo
Adams Conservation Club. Kings Rd. near Toledo. Annual picnic.

13 . . Eastern New York
Endries Park, Schenectady. Annual picnic.

19 . . Tri-State
Stauffer's Recreation Center, Tulsa, Okla. Annual stag party.

20 . . Central Ohio
Columbus Riding Club, Columbus, Ohio. Picnic and annual outing.

20 . . Quad City
Camp Nobel, Rock River. Annual picnic.

27 . . Northeastern Ohio
Twin Lakes Country Club. Annual outing.

July

18 . . Northwestern Pa.
Picnicana, Erie, Pa. Annual picnic.

Offer Driver-Training Film

A training and safety film for industrial truck operators is now available. The 30-minute, sound movie is titled *"Safety Saves."* Filmed "on-the-job," it illustrates "do's and don't's" of safe driving and shows how to avoid causes of most truck accidents.

Villain of *"Safety Saves"* is Willie the Cowboy, a lad who drives his fork truck like a hot-rod. Willie doesn't look where he's going, ignores overhead clearance, and parks his truck in the middle of busy aisles. Willie is a menace—to fellow employees, to the goods he's handling, and to himself.

Nearly Succeeds

Narrator of the film tries to teach Willie the error of his ways, and nearly succeeds. But unfortunately, before Willie finally learns, he makes one mistake too many and is carried away from the last scene on a stretcher.

Along with examples of how not to handle a fork truck, the movie shows the safe, correct method. Besides fork truck operation, *"Safety Saves"* contains instructions for operators of towing tractors and hand trucks.

"Safety Saves," produced in response to requests from truck users for a driver-training film, was made available on a loan basis March 1. For a reservation form, write the Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.

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..for Midwest electric steel foundry producing approximately 175 tons per month of jobbing castings. Must have practical experience, especially loose pattern molding. Give full details, experience, personal information, salary expected. Replies confidential. **HW-649**

Foundry Superintendent

Good opportunity for man with all-around Iron and Steel Foundry experience. Take complete charge of Coremaking, Molding, Melting, and Cleaning sections. Should have experience with pressure castings. Permanent position with well-rated southeastern Ohio manufacturer.
Replies confidential. Submit complete resume—experience, education, age, approximate salary requirements. **HW-650**

Salesman-Foundry Supplies

Familiar with Midwestern Foundries to sell and service a basic foundry material. Technical background helpful but not necessary. Write giving full details and references. **HW-651**

Foreman - Iron Foundry

Foreman to take charge of iron foundry located in New Jersey producing castings from one to fifteen hundred pounds each. In reply please state age, experience, and salary expected. **HW-652**

Sales Engineer

Expanding company has attractive opening for reliable man capable of selling and servicing foundry accounts. Knowledge of foundry sands essential, foundry experience desirable. Mid-west location. **HW-653**

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